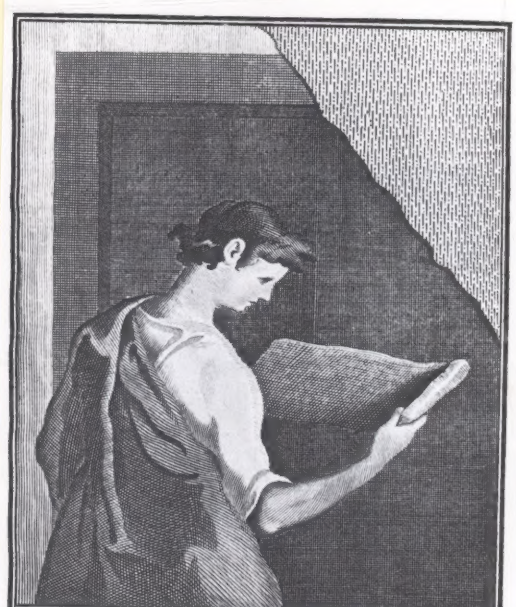

Royal Institute of British Architects.

INCORPORATED IN THE SEVENTH YEAR OF WILLIAM IV.

THE TRANSACTIONS.

SESSION 1882-83.

USUI CIVIUM, DECORI URBIUM.

LONDON:
PUBLISHED AT THE ROYAL INSTITUTE OF BRITISH ARCHITECTS, 9, CONDUIT STREET, HANOVER SQUARE, W.

SEPTEMBER 1883.

Entered at Stationers' Hall.

DRYDEN PRESS:
J. DAVY & SONS, 137, LONG ACRE, LONDON.

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SESSION 1882-83.

I. THE OPENING ADDRESS. By Horace Jones, *President.*

[Read on Monday, 6th November 1882.]

GENTLEMEN AND FELLOW MEMBERS and Visitors,—To-night, on the opening Meeting of the new Session, it is my duty, my privilege and my desire, also I may add my pride and pleasure, to address to you a few words. The events of the past Session, the hopes and expectancies of the coming one, and generally the passing events of the architectural world, and the sister arts, will easily afford such a wide and extensive field, that the difficulty of adequately deserving your attention lies less in the importance of the various subjects of interest before us than in my own doubts as to the sufficiency of my power of exhausting any of the points of interest before-named, due regard being paid to the shortness of the time before us to-night. Not, however, to waste more words in the preamble, let us pass the late Session in review.

Joy and sorrow are mixed and often intermixed so closely with our life that the brightness of the first would only seem to cause the shadow of the other; to-night we will reverse the picture and let the shadow have precedence. The obituary of the year has been very considerable, and we have here the lesson brought before us that architects are indeed mortal, for we have had more than ordinary losses, and they have been of a more than ordinarily serious and mournful character. Those whom we have lost have been honoured and lamented, and notices of some of them and of their character and position have been communicated to you in the Transactions of the Institute which have been just published. Indeed the loss of our President, and his being laid in his last resting-place amongst the worthies of Great Britain, has become thereby not merely a professional but a national record of our loss, and by this recognition of his talents, character and professional position, a matter of national history rather than merely a professional incident. It is not less strongly brought to our minds on considering the circumstance that at this very period, in all probability, the arrangements are being made for the opening ceremony in respect of his greatest and most important work, indeed the greatest and most important work that we have seen completed and inaugurated since the Houses of Parliament at Westminster were finished; and we should have hoped, had he lived, that some public recognition of his labours, skill and talent would have been granted to him. Nor is it scarcely likely that we should forget his strong advocacy for the preservation of the churches, &c., in the City; nor remember with other than satisfaction his brilliant and exhaustive Opening Address last year. One further act remains to us to perform, and that is to place his portrait as a memento of him on our walls. It has been often mooted that this portrait painting should not be an inflexible and invariable custom, but I am sure that none here would like to make the break upon this occasion. In another place, with larger means, perhaps a more enduring memento—for it is reasonable that canvas should not outlast marble

—will be raised to him, namely, a monument in the new Royal Courts of Justice; but that is no reason why we should deny ourselves the right for his semblance to grace our walls. I may add here, that the portrait of one of our late esteemed Presidents will not hang in this room for some time, it having been sought for to be hung in the Grosvenor Gallery amongst the collected works of our friend and Associate, the gifted and excellent artist, Alma Tadema. We have also lost three old and esteemed colleagues, all Past Vice-Presidents, and two of those are in their wills contributors to our funds, namely, Mr. Decimus Burton and Mr. Mocatta. The third is Mr. Anthony Salvin. None of them perhaps have been much known, of late, in the professional world, but it must not be forgotten that half a century ago the first of these gentlemen, Mr. Decimus Burton, was a ruling power and light in our profession, and Mr. Mocatta, if less known as a practising architect, has always evinced great pleasure in and love towards our art, and great solicitude for our well-being. There is, however, a more recent loss. Amongst others there is that of our late fellow-worker George Somers Clarke, whose more recent death has allowed us no opportunity of even honouring his memory by the most casual mention. He was well known and highly esteemed by many. As to myself, I have known him and appreciated him long, and have lost in him not only a fellow-worker, but an esteemed and special friend and colleague. He was, as many of you probably know, a pupil of the late Sir Charles Barry. He travelled through Italy, France and Germany five or six-and-thirty years ago, and you will find his name as a contributor to the Dictionary of the Architectural Publication Society. A list of his works has been published, and our deceased colleague will probably be the subject of a more extensive notice than I can give him here, from the pen of one or other of his professional friends. Suffice it to say that such works, amongst many others, as Talliss's Printing House, which was destroyed for the Metropolitan Markets, a Warehouse in Wood Street, Cheapside, the Auction Mart and contiguous buildings in Lothbury, and some of his country houses, more especially one for the late Mr. Hermon, mark well the talent and originality of his mind.

The Annual Report emanating from the Council, with the usual statistics as to the numbers, and the various accessions to the numbers, of the Members of the Institute, are clearly set forth in the Journal of PROCEEDINGS, and are accessible to all who care to read them, and it is scarcely necessary for me here to refer further to them. The same remark applies with perhaps the same force to many of the ordinary affairs of the Institute. Not so, however, can I so lightly pass over some of the Essays and Papers which have been read before us, and some of which have been more than usually interesting. The Paper upon Ornamental Ironwork came to us as a most acceptable Essay, and though it could have been wished that Mr. Stannus could have had a longer time than the usual number of minutes allotted to him, to have enabled him to have given us a more exhaustive Paper, yet we are quite willing to accept it as a prelude to a further and future Essay, there being, I am quite sure he will himself feel, room and matter enough for one, if he can and will find time and leisure for the production of another Essay when a future opportunity occurs. The author, as many will remember, delivered his little Essay in a manner that would have rendered a less excellent Paper pleasing and agreeably acceptable. The Paper by Mr. Slater on Electric Lighting was, perhaps, even a more popular production: the usefulness of the subject, the interest all felt and exhibited in the wonderful adaptation of science to the comfort, aid and advantage of

the whole world, the universal interest which has produced several national and international exhibitions devoted to it alone, would render it of enormous interest to everyone; condensed as it was it taught us much in a pleasant, easy and popular form. It is not necessary for me to expatiate on the position Electric Lighting has arrived-at, but we all feel that it has made itself an element of our daily life, and any similar attempt to popularize and explain it must be always received with thankfulness, especially when the information is conveyed to us in such an easy and graceful manner as was done by the author on this occasion.

I must also call your attention to the important labours which a section, not only of the professional Members, but also of the Honorary Associates, and I believe some outside friends, have devoted to the adjustment of the vexed question of Light and Air. The Report is not yet ready for presentation to you, but when it is, it will be found, I believe, a useful, valuable and exhaustive report. It is a matter of which, having had many minds brought to bear upon it, many views are taken; and to harmonize these in some measure, to arrange them in some order, and to bring them into a useful compendium, requires time, care and discretion.

There are also two or three other questions before your Council which I beg you to consider are being delayed more from a desire to make them as perfect as they can, when the respective Reports shall be presented to you, than from any supineness or indifference on their part.

The Session of 1881-82 will long, I trust, be memorable for the inauguration of our long-sought and by many most desired system of compulsory examination. Your Council, you are fully aware (for the subject has been before you on various occasions) had given this question long and serious consideration, and they determined that the course of that examination should not, at least in the first instance, be too rigid or too exhaustive. Here let me express my opinion that the thanks of the Institute are due to the members of the Board of Examiners in Architecture. I can assure you great care, labour and intelligence are exercised with moderation, good taste and kindly feeling in this important matter; and whilst I have not hesitated to express to them personally my appreciation of their labours, it affords me an additional pleasure to bring under your notice, amongst others, Messrs. Gruning, Mathews, Robson and Watson, who not only acted as Examiners but took a keen interest in the whole matter. At present it might truly be thought to be only of a preliminary description, not aspiring to more than to such matters as the knowledge of which is absolutely indispensable to any person seeking professional employment as an architect; and I thoroughly believe that whilst it will be facile and wise to increase the extent and stringency of the Examination, and to raise the list of acquirements, it will be difficult and injudicious to start from such a level as would require us to lower the character of such examination. Very much remains to be done in future years, not only by the Council and by the Board of Examiners, but also by the candidates themselves. The Examination must necessarily take a scientific and practical, rather than an æsthetic tendency. Art cannot be measured quite in the same way as arithmetic or mathematics can. The æsthetic portion might, with the alteration of a word, have applied to it Cowper's words relative to a poet, who says:—

"A poet does not work by square or line
"As smiths and joiners perfect a design."

And though the Examination is naturally limited, so that success may be within the reach of any reasonably intelligent man who has devoted a few years to acquiring the necessary

knowledge, yet the art portion of our profession must be tested in another way. Perhaps, as to a knowledge of art, no better test exists than is to be found in the competitions for the various medals and other prizes offered by the Institute. These are as you well know numerous, and one or two of them are of considerable realistic value, irrespective of not the least valuable, though perhaps less tangible, element in them, to wit the honour.

Let me here take advantage of the opportunity of expressing not merely my own views, but, I believe, the views of every member of the Council, of the great advantage the work of the Architectural Association has been and is, in preparing many of our best candidates for the work of examination. It is also the duty of our Institute to guard as much as possible against any infringement of the code with regard to the conduct of our employers' affairs, and to inculcate in the minds of all persons joining our craft, that they cannot be too careful with regard to the pecuniary affairs between themselves, their employers, and those whom they may employ on behalf of their own employers, either as contractors or in every class of tradesmen or dealers. This is one of the principal traditions which should be handed down from generation to generation; and the more carefully it is guarded the better chance have we of carrying out that strict principle of rectitude which is contained in the professional axiom—that we should first think of doing our duty to our clients before we consider the question of remuneration to ourselves; and that no illicit gains, however small or however large, should at any time enter into our imaginations, and still less into our pockets. The Royal Academy, largely endowed as it is, is able to offer more valuable awards and honours than we can; and I believe they are always given with great care and appreciation of the various talents exhibited. The curriculum of its architectural school, under our friend, Mr. R. Phené Spiers, shows that in many portions of the art there is no want of opportunity for a student to perfect himself, as well as in many of the scientific branches. The Academy is, however, I believe, principally confined to that which is artistic. Not only must there be careful drawing, but modelling also, with attendance at lectures upon perspective, &c., and liberal rewards afford additional inducements to attendance and to study. The Professors of University College and King's College vie in offering to their students additional aids in mastering the theory and practice of our art. There has been a considerable outcry against the want of a museum of models and casts. No doubt such a museum well arranged would be a great boon to many; but such should not be considered as in any way a substitute for the thorough examination and study of the originals, in existing buildings. Yet, notwithstanding the various schools and processes by which a man may arrive at a knowledge of his profession, and fit himself not only for the present examination but for a future and higher and more stringent one, there still remains that which I, in all humility, think is not lightly to be passed over, viz., the practical education learnt in the transactions of current, ordinary every-day business, and which could be best if not solely learnt in an office. And here there is often a division of opinion as to whether the advantages to the student are greater in a large office and practice, affording more experience perhaps in important and varied work, than in a smaller office where there is less work but more opportunity for personal supervision and attention from the principal. However, routine and regularity are absolutely necessary in most divisions of professional practice, and in neither case is the often and much-sneered-at system of "red "tape" entirely useless; and though, perhaps, a bad master, it may often be found a good and

useful servant. There is also much detail work in every calling that is best learned very young, and although, perhaps, not of the highest class of intellectual employment, yet it leaves on the mind a ready reference of detail, useful in after years upon the spur of the moment, saving much time, and often enabling rapid decisions and results to be arrived-at which would appear instinctive or intuitive to those who had not been closely trained in these apparently petty details in early youth.

Perhaps I may be pardoned a slight digression here, and do not hold me too presumptive if I compare the question of examination, which many of you well know I and some others have been for the last twenty-five years fighting for, to the more stringent, the more important, more frequent, and older examination for the military profession. I hold and think that any examination testing the scientific requirements of the maturer and readier intellectual qualities of the young architect need not militate against his artistic and æsthetic powers, any more than the scientific training, education and examination of the aspirant for military employment need exhaust his physical qualities, or his moral ones of courage and conduct. The recent events in Egypt are the best confirmatory evidence of the truth and force of my argument.

I would also here allude to the various colleges or schools of practical engineering; I think it would not be a loss of time if the Institute were to give its countenance, if not its aid and assistance, in the technical teaching of such a college or school, in those trades more particularly under the control of the architect. The Technical College known as the City and Guilds of London Institute, now coming into use, appears to consist of four departments: 1. Practical Mechanics and Mathematics (the students of this department being also expected to devote a certain portion of their time to laboratory and exercise work); 2. Electrical Engineering; 3. Chemical Department; and 4. Art. Whilst this college could afford to the younger members of our body the means of learning the more ordinary mechanical avocations or artificers' works, we could assist it in giving some aid in the study of the more scientific and æsthetic branches. Of course I have not forgotten the advantages which a young man should avail himself of by being engaged in some useful way upon a work or edifice in progress. If upon some building he would give a very short time every day to keeping an account of the progress made, he would be astonished what little time it would require him to give, how useful it would be generally, and what an enormous amount of practical knowledge and information he would acquire without apparently devoting himself to it. And further or later on, the charge and general superintendence of the work would be a still greater help to him, and would pave the way for him to avail himself, to his great advantage, of travel, whether at home or abroad, and the study of works already executed, whether ancient or modern. Not only to the junior student, but also the professional man and artist, whose heart is in his calling, and who remains a student all his life, need I point out the great advantages within each man's memory that have sprung up in the way of national and international exhibitions, not only through Europe but also in America. And whilst on this question of International Exhibitions I think there is room for an International Congress on more than one point. The want of some mode of international communication on matters of constructional and sanitary interest must, I think, have been felt through the late panic caused by that terrible catastrophe at Vienna, and the attention which was drawn to the

construction of theatres by the public authorities in Austria, caused no doubt on the principle of the burnt child dreading the fire, with regard to the difficulties the Austrian authorities have hedged around the architects with respect to any new or proposed theatre; and though I mention theatres as being the buildings which I fancy seem to have the greatest amount of paternal care bestowed upon them, yet there are, no doubt, various other buildings both public and private, a little consideration regarding which, amongst the competent men of different nations, might improve the efficiency and convenience of such buildings, and would also tend to moderate any unnecessary or impolitic interference.

Everyone who has not absolutely lost the use of his eyes must have often been amused at the sudden turn the public mind has taken for exterior colour; and though some of the colours with which our fellow-citizens decorate their houses may at times call up a smile, yet they at least give an air of cleanliness and liveliness to our streets, whether they fulfil all the requirements of a fastidious critic or not. But already the colour is not merely on the outside, the taste for colour is rapidly pervading the interiors: our living rooms in ordinary houses are such as would have astonished the dwellers therein twenty years ago. Our friend Mr. Aitchison, who has more than once amused and instructed us with his Essays, has not only been devoting his time with considerable success, as you are possibly aware, to the interior decoration of our houses, but has also spoken out at one of the Provincial Congresses, and we may perhaps trust that he will kindly come and tell us something that we should be glad to learn, and assist us in guiding the mind of the general public into such a direction as may be best conducive to the improvement of the public taste.

The Session has not been particularly prolific in the production of architectural literature, though such things as the Edmund Sharpe Memorial promoted by the Architectural Association are not common. The sentiment of its publication, with its usefulness to the professional as well as the general art student, will render it a highly prized and esteemed work, unique of its kind, and honourable alike to those who produced it as well as to him to whom it was dedicated.

Of course there is always something doing and to be done in the question of restorations at home and abroad. The restorations at Bristol, under our friend Mr. J. L. Pearson, R.A., will no doubt be the means of adding another leaf to his laurels, although some regret has been expressed that restoration should involve the destruction of the Abbot's lodgings. St. Alban's still affords subject for discussion and criticism, and will probably do so for some time to come. The Tower of London is, I believe, also likely to receive the attention of the restorer. The excavation at Ephesus is another archæological matter which has interested the intellectual world. I am but repeating what you already know in saying that Mr. J. T. Wood has devoted many years of patient toil and research to the subject, and we can only hope that an undertaking so nobly begun and persevered-in will be ultimately crowned with complete success. The Temple of Diana was unique among Greek temples. It is not a copy of that of Minerva at Athens, it has an idiosyncracy of its own, placing it as a type or school by itself. I cannot do better than repeat the words of Professor C. T. Newton, viz., that the complete excavation of the Temple of Diana at Ephesus is an object well worthy of support from the nation, which now possesses in the British Museum the only portions of the beautiful sculptures as yet discovered of the Temple. And further, the necessity that there is for finding the

"sinews of war" for future work. Of course these cannot be raised by the members of a profession which is not too well remunerated, and amongst them there must be a large number of men who have not much to spare for purposes of this description; but their voices raised in favour of it perhaps may enlist the responses of those who are better able to assist. The cessation of his labours was a bitter disappointment to the man who has made so many personal sacrifices, including his professional prospects as an architect, just at the time he expected to find the most important remains of the temple, including the sculptured frieze and cornice. Mr. J. T. Wood will, let us hope, not fail in enlisting substantial sympathizers, and be thereby enabled to prosecute and complete the work he has so long and so unselfishly laboured at. I trust that we shall hear of and, as far as in our power lies, help to this satisfactory result. In conclusion, let me add that some Roman remains appear to have been recently found at Bath, and a more important discovery of a "Gallo-romano" city near Poitiers has been noticed among the news from France.

The municipal improvements throughout London have not perhaps been so very marked this year as in others. One still sees the red brick of "Queen Anne," as well as a good deal of Flemish and Dutch architecture reproduced in every part of London and the country. Some large thoroughfares are projected to be thrown open, more especially in connection with the Royal Courts, and not before they are wanted. Clare Market and some of its surroundings are probably doomed, and that old nest, once contiguous to the home of fashion, will be cleared of its present wretched hovels and dwellings, scarcely fit for human habitation. Another and less expensive improvement in this neighbourhood has also, I believe, been laid before the Metropolitan Board of Works by the District Surveyor of the locality, Mr. C. F. Hayward. With regard to another question of metropolitan improvement is the suburban one of Hammersmith Bridge, and no doubt the new bridge will prove to be a handsome structure, equally worthy of the Metropolis, the powerful body who inaugurates it, and the able engineer who has the designing and superintendence of it. With regard to bridges below London Bridge, and the communication between the north and south sides of the Thames in that district, I am inclined to be very reticent; but I cannot help expressing a wish that it will be long before the estuary bringing the commerce and mercantile navies of the world into the heart of the city of London will be abrogated. Pardon me for here introducing a personal anecdote. Some few years ago, wandering on the banks of the Garonne at Bordeaux, and speaking to one of its citizens, I incautiously expressed a surprise that there was no immediate communication between the north and south banks of the river, studded as the north side was with villages, châteaux, vineyards, &c., and involving a *détour* of two or three miles to those who wished to reach the opposite side. My acquaintance, looking at it, said: "You speak as an architect or engineer, "who would gladly rival here the bridge you see two miles off in the distance; but we would "rather go double or even five times the distance than drive away our sea-going ships from the "quays. If we had a bridge where we now stand, the trade of our quays and port would be "carried off to the mouth of the Garonne, probably to Rochelle, or perhaps to Nantes; and "probably then the city of Bordeaux would lose one hundred or one thousand times more in its "wealth, and the interests of the inhabitants by the loss of their commerce, than it would gain in "the convenience of a ready access from one side to the other." I felt the wisdom of his remarks, and have often thought them applicable to the City of London, and hope that it may

be long before the commerce, which has tended to make it what it is, should be sent down to Blackwall, Gravesend, or perhaps to Southampton or some other distant port. Another form of metropolitan improvement, which I think is much upon the increase for more than one class, is the number of flats and associated dwellings. They answer for the less wealthy classes, and they are now beginning to be appreciated by those of a wealthier description, and we shall in a few years see that if they are not as common as in Continental cities, yet they will be more prevalent than they are at the present time. The more important governmental works and the improvement of Public Offices, &c., seem now to be looming practically within sight. It is to be hoped that no morbid economy will step in and interfere with public convenience and the decoration of the Metropolis by public edifices. All classes benefit by a liberal expenditure on public works—those who inhabit them and utilize them, as well as those who pay partially for them, but at the same time receive nearly the whole of that back in remuneration for their labour and exertions.

The subject of competitions is always a matter of interest to ourselves, either one way or the other, for it is quite clear that they are not viewed by all classes or all persons in exactly the same light. Amongst others I would allude to the Glasgow and Birkenhead competitions, both of which have had, so far, successful results. Well and carefully considered conditions produced in the former case (Glasgow) some one hundred and forty competitors, from among whom ten were selected (on the principle of giving each a premium or payment) for the final competition. In the latter case (Birkenhead) one hundred and thirty competitors sent in preliminary sketches, from whom five were selected on the same principle, and in both cases the commission has been confided to the successful competitor in the final competition. I think we ought to endeavour this Session to bring to a conclusion the discussions on this head, and put forward the views as to the regulations that should be required by the Institute to govern these matters in all cases. Perhaps, the most important competition for a building abroad was for the Berlin Senate; but how it may eventually turn out is, of course, *in futuro.* Amongst the principal public and private buildings that have been completed this year scarcely one stands so much before all others as to command special notice or criticism. There has probably been the average number of churches and chapels, poor men's houses, and princes' palaces, as well as a long list of scholastic buildings, with a theatre or so, a bank and insurance office, &c. To classify, criticize, praise or blame, would require more than one evening (of the time allotted to an ordinary essay), and I can only regret the length of this Paper forbids me to attempt anything of the sort.

From the past year let us turn to the future, and first let us take our own selfish interests. The examination instituted last Session will, I trust, bear fruit next year, and bring us many candidates prepared to enter our ranks as Associates. With respect to our Honorary Associates, it was a step most useful and valuable that we took a few years ago in seeking the association not only of the general public but of our brother artists. It is no small pleasure to see amongst us painters and sculptors; and the more we see of them and the more we know of them, the more likely are we to be able to utilize their skill, their talents, and their genius for embellishment of the edifices under our care—advantageously to us, advantageously to them, and, more than all, advantageously to the general public. And whilst we are knitting the bonds as fellow workers we may perhaps improve and strengthen them; for I think there

is room for both improvement and strengthening the union, the competition, and I am bold enough to add friendly competition, between ourselves and the Royal Academy. Do I trespass unfairly on dangerous ground when I hint that the Academy would be more popular with architects and more advantageous to them, without derogating from its utility to the public, were the architectural section under a more catholic regime than it has been for some years?

There is also one more very important point, and so important is it indeed that I feel the expression of an opinion upon the matter is almost of vital importance; and although I approach it with some preamble, it is with no hesitation or indifference. We are a body spread widely over the world; British Architects—like our mariners—may almost be said to be "*per terram per mare;*" in fact, we may say, in no quarter of the world are their works unknown. No doubt the largest and in some respects the most important section are in London, not that I mean in any way to reflect upon the talents and abilities of our provincial brethren, on the contrary, there are many of them who stand as high as any metropolitan Member, some may perhaps say higher, but I do not wish to bring any words into use between us that may cause any more than fair and generous rivalry. Though I believe this is quite the case, yet there are some who think that the metropolitan Members have the advantage in the use of the Institute over their non-metropolitan brethren, and that, whilst the burden of support falls equally upon all, the benefits are not so equally distributed. A Conference has indeed been asked-for by the Manchester Society, on behalf of a very large number of influential and important persons, and the Council will, I am sure, receive them with pleasure; hear them with attention; redress their wrongs, if they have any, with justice; and also mitigate their sufferings, if they prove them. In other words, their metropolitan brethren and the Council wish to see as much equality as possible, and certainly to leave the non-metropolitan Members with no cause for discontent.

I also venture to express a hope that some of our proceedings this Session may be interesting to the general public as well as to ourselves. I believe that one of our old and esteemed Vice-Presidents, Mr. I'Anson, will give us some account of his visit to Cyprus; and a Paper on a not less interesting subject has been promised by our Fellow, Mr. Pullan, whom we all know is brother-in-law to our late lamented friend, Mr. William Burges, and who, following in his footsteps, proposes to treat us to an Essay upon the decoration of St. Paul's. I have no doubt it will be interesting in the highest degree to many, exciting to a few, irritating I believe to none, and instructive to all. Mr. Gale, the first holder of Mr. Godwin's Bursary, will also bring us a contribution telling us what has been done and what is doing in America; and travelling still further, Mr. William Simpson, not for the first time delighting us, will give illustrated notes of the architecture in the Himalaya mountains. And I think that, apart from any semi-archæological, as well as architectural or historical, Papers, some of the most recent improvements in manufacture, especially fictile wares, might be brought prominently before us; the question of colour, external and internal, in buildings would, I might suggest to some of our Members, be a very valuable addition to our evening instruction and amusement, as well as, I think, popular to the public generally.

Much more could be said on the various points of interest to our body, and I hope I have not laboured the educational question at the expense of other points of interest; but it was unquestionably the great work of last year, and as I have said before the advantage to

ourselves, in more ways than one, is shared by the general public, for whatever raises our scale or standard of excellence is also beneficial to the outside world. In closing a review of the year's work, none of us, I am sure, would be satisfied were I not to allude to our successful evening at the South Kensington Museum. I do not mean so much for the purpose of congratulating ourselves on the way in which we received our friends, which however I believe was thoroughly appreciated both by old and young, as well as by those of the fairer sex who adorned, and added beauty and grace to, our entertainment; but we must not omit to express our thankfulness to those who enabled us to please ourselves and our friends so well. The authorities of the South Kensington Museum, I understand, did a great deal more for us to meet our views, wishes and comforts, than we had any right to expect, and the hearty expression of our thankfulness will give you, I am sure, as great a pleasure to express as it does me to call your attention to it. Time will only permit me to thank you for the kind manner with which you have listened to me, and to add that I regret that the dryness of the subject has not made it more entertaining, but if it prove useful and has satisfied you I shall be content.

Mr. CHARLES HUTTON GREGORY, C.M.G., Past Pres.Inst.C.E.—Mr. President and Gentlemen, the duty which has been intrusted to me is one which I feel to be a very great honour: that of proposing a cordial vote of thanks to the President of the Institute of British Architects for the interesting and instructive Address which he has just now delivered. Sir, on such an occasion, I cannot help looking back to a period of nearly half a century ago, when, through the kindness of my dear old friend Professor Donaldson, I was allowed as a young engineering student to attend the meetings of this Institute—very different then from what it is now; then it was a struggling body, kindly and warmly supported by good men, but it had not then attained the position which it has now so long held as the representative body of your noble profession. Still I recall with some pride the fact of having been allowed at that early period to present a Paper to this Institute. I might add something more of a personal nature with regard to the many friendships which I have been allowed to form among the Members of this Institute, but that subject, however pleasant to me, would be going beyond the limits which have been assigned to me. I will not attempt, Sir, to follow your Address through its different stages, but I may be allowed to say that I am sure all your hearers must have felt with me that its leading features were peculiarly characteristic of the distinguished architect who delivered it. All must have been impressed by its geniality, and by its touching allusion to Members you have lost by death, and especially by the delicate generosity with which you spoke of the talents and the works of your eminent predecessor. I noted also, Sir, in that Address the strong determination to keep up the character of your profession, and to maintain by precept, as you have throughout your honoured life done by practice, a high standard of integrity as essential for those members of the profession who have to follow you, and in time aspire to the honour of that Chair. I feel too, Sir, that you have just hit the happy mean in the combination of theoretical education and practical knowledge which is so desirable in your profession as well as in my own. And, lastly, in that Address I observed so little allusion to yourself or your works, and so much to all those to whom you could give a word of advice, a word of encouragement, a word of congratulation or a word of kindness. I

am aware, Sir, that during the past year those of your own works which have been executed have not been so extensive or so prominent as in former years, still I do not think that the year's work in architecture would be complete without a reference to the finishing of that truly metropolitan work, the great Markets at Smithfield, by the carrying-out of the Fish Market. Now, although an engineer may be considered incompetent to give a criticism upon design, he may venture to speak of the great convenience of public buildings, and the excellent way in which these Markets are laid-out, both below ground and above, are due, Sir, to your directing care and ability. There is one other work which, although it is at present only on paper and in a model, is one that will add another distinguishing and most interesting feature in the list of your handiwork in the City of London, and that is the new Council Chamber, which I believe will do great credit to your ability and power as an architect, and also be a very worthy addition to the Municipal Buildings, to the Guildhall transformed and beautified, and to the City Library designed and executed by you. There was one work of yours, Sir, that I very much wished could have been perpetuated, and which had a transient existence on the route of the Queen when Her Majesty and the Prince of Wales went to the thanksgiving service at St. Paul's Cathedral. This work, which won the admiration of all who saw it, was the triumphal arch at the foot of Ludgate Hill, and though that beautiful design does not live in imperishable stone in the City of London, it still survives in the drawing of it which occupies an honourable position on the walls of Her Majesty's private apartments at Windsor Castle. I have now only to express the gratification it gives me to propose a vote of thanks to a very highly valued friend of my own, one with whom I have had the pleasure of working professionally, and one whom I esteem in every walk of life in which I meet him. I know he will make you a good President, and that when he vacates that Chair you will look back on the close of his year of office with affectionate regret. May he long stand here to give his countenance to this Institute which he loves, and may you, Gentlemen, accord for his sake a hearty reception to the vote of thanks which I have proposed.

PROFESSOR T. ROGER SMITH, *Member of Council.*—Mr. President and Gentlemen, I feel it a great privilege to be permitted on this occasion to second the vote of thanks which has been so appropriately proposed by a distinguished member of the sister profession. I am sure, Sir, that no one can have listened to the way in which you reviewed the work of the past, and sketched-out the programme for the future, without feeling that we had in you and in your work to-night an excellent example of the value of a professional President. Your Address was eminently professional, and also eminently presidential, and we have to recognize that neither the smaller nor the larger matters which belong to our work, our Institute and our education, have escaped your notice, but both have received from you due recognition. I feel particularly—and the same thing was alluded-to also by the previous speaker—the kindly manner in which you have succeeded in enumerating the various services rendered to the cause of architecture in various ways during the past year by a very large number of persons of whom you have made mention. Not only the kindly and touching references to those who are dead, but the allusions to the work of those who are living among us, have been appropriate, and will, I feel sure, act as an encouragement to those who help this Institute by showing them that their work does not go unrecognized. I feel especial pleasure in standing here and thinking over the work of many past years which has brought to something like a successful issue the examinations to

which you devoted so large a portion of your Address. There can be no question that the step which was taken when a compulsory examination for architects was established is the most important that has been taken by this Institute for many years, and I think I may add that there can be as little question that this could not have been possible, or even thought of, had it not been for the voluntary examinations which were established by our body, and which have been continued with more or less success for a period of something like twenty years. I am aware, Sir, that this movement has always had your warm sympathies. I know that it has had in you a steady supporter, and that whenever an impulse could be given to it you have been willing to give it; and I am happy to congratulate you in occupying the post of President at the time when this most important result of labours, in which you have taken great interest and some share, has arrived at a state of comparative completeness. We have of course to look forward. We hope to see a higher standard, possibly a more stringent examination, possibly a greater variety of subjects; but I trust that the model now set will be always adhered-to—that the examination will continue to be what it now is, namely: an examination in professional subjects, so that it may act as at once a guide to students, and, what is no less important, a guarantee to the public that those who pass it have been giving their attention, with success, to the subjects which they ought to study in order to fit them for practice. It is by no means, Sir, necessary to go over the subjects that you have in various ways brought before us. I will therefore only do myself the honour to second the vote of thanks, and in doing so I should like to be permitted to offer my personal congratulations to a very old and highly valued friend for having attained a position to which his personal merits and the excellence of his executed works as an architect so well entitle him.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS. By Edward I'Anson, F.G.S., *Vice-President.*

[Read on Monday, 20th November 1882, Horace Jones, *President,* in the Chair.]

HAVING read a recent work written by the Chevalier di Cesnola (who acted as Consul at Cyprus for the United States of America), containing an extremely interesting account of the researches he made there, which resulted in the collection of a large number of coins and objects of great interest in terra-cotta and glass, I determined to visit the Island, containing as appeared from his work so large a number of ancient tombs, and being the known site of temples raised to the honour of Venus, to see if I might not discover some fragments of Grecian architecture; but in this expectation I was disappointed. In order, however, to make the following observations more intelligible, it will be well first to describe the position of the place. Cyprus, the Chittim of the Old Testament, is within sight of the Turkish provinces of Asia Minor, within twelve hours of the coast of Syria, and within thirty-six hours of Egypt. It is about one hundred and fifty miles long from east to west, and in its broadest part sixty miles wide. The Turkish provinces of Asia Minor represent the ancient provinces of Cilicia, Lycia and Pamphylia. Syria is still Syria, and borders the great ancient Empires of Assyria, Armenia, Babylon, Media and Persia; and Egypt is on the south. This comparatively small Island was consequently in the midst of the great nations of antiquity. In turn Egypt, Phœnicia, Greece and Rome, the Crusaders with whom it was a frequent halting place on their way to and from the Holy Land, and lastly the Turks, have occupied it, leaving behind them traces of their successive settlements. Very little remains of the buildings of the more ancient conquerors, except in tombs and their precious contents, but the descendants of the Crusaders have left many fine works to testify to the wealth of their dominion and to their skill as architects.

With the history* of the many changes which took place in the occupation and government of the Island it is unnecessary for me to trouble you, as it is recorded by numerous writers on the subject, beginning as far back as Herodotus and Aristotle; but it is necessary, having reference to the subject of this Paper, to mention that our Richard Cœur-de-Lion took the Island in 1191, and sold it to Guy de Lusignan, a French Crusader, who established the Kingdom of Cyprus, and whose dynasty held peaceful and prosperous possession until 1372. It subsequently passed into the hands of the Genoese and, in 1489, of the Venetians; in 1570 it was conquered by the Turks, to whom it still belongs, although we English now administer its government for them. Whatever works the Egyptians and Persians may have left, no traces remain; the few works which precede those of the Romans are attributed to the Phœnicians. Traces of the byzantine occupation do, I think, remain. Of the Arabs I could trace nothing, at least nothing like the work of which they have left such fine examples in Cairo. Of the gothic occupation, however, many interesting examples remain; of the Italian or Venetian but little, and of works of the Turkish occupation also but little,—merely a few mosques, a few tombs and some aqueducts. The Turks appropriated the buildings they found suitable for their own purposes, obliterating such portions as their

* See the foot-note at page 20.

religion deems objectionable, namely, carved images, painted glass, and mural decorations, or any decoration in which the human figure is represented. In this way all the glass has been removed, and replaced with thin perforated slabs of stone, or more commonly with perforated slabs of plaster of Paris.

In the category of the most ancient works must, I consider, be placed a tomb partly hewn in the rock and partly constructed. It has an outer chamber, the sides of which are formed with hewn masonry, and the top is covered by a monolith which measures fully 12 feet in width. There is an inner chamber beyond hewn out of the rock, and between the inner and outer chamber a groove, in which there appears to have been a moveable slab of stone, to separate the inner from the outer chamber, and to close the former. The soffit of the monolith covering is slightly hollowed-out in the form of a flat arch. This monument is near Larnaka.

Another monument of pre-Roman time, known as the Ai Katharina, is near Salamis, and it was, I presume, a tomb. It is 33 feet in length and 20 feet in width. The roof assumes the form of a pointed arch; the stones, of which the roof is composed, are of colossal dimensions, and although they are so placed as in effect to form an arch, it is an arch of the rudest construction. On one side there is a chamber at right angles to the larger chamber called the treasury, the roof of which is formed by two inclined stones abutting against each other, like the stones which are placed over the entrance to the great pyramid of Cheops. There is a cornice to the large chamber formed by a cavetto moulding, like the external cornices of the Egyptian temples. The stones of which the roof of this tomb is composed are much weather-worn and mutilated; but I think the lower stones certainly bear indications of having been moulded, and there is also indication that the covering stones of the arched roof were stepped like the stones of which the great pyramids are built [Illustn. i, fig. 3].

There are abundant remains (among the ruins of the ancient Citium) of tombs in the Island. Near Salamis, near Kerynia, near Larnaka, at Paphos, in the immediate vicinity of Nikosia, and in other places, tombs have been found for the most part constructed in the solid rock. Generally the tomb is hewn out of the rock, and the head of the entrance has almost always a slightly-arched form. In only two, of the many I saw, was there any architectural form; in one near Kerynia there was an entablature, surmounted by a depressed pediment, with the doric triglyphs and guttæ in the frieze, evidently late Roman. Another which I saw cleared and opened, near Salamis, had a small entrance court which had probably never been covered; the walls which on two sides were exposed to view had an Egyptian cavetto cornice, similar to the interior of the tomb at Ai Katharina. The roof of this tomb, the only one I actually saw opened, was formed either by two sloping slabs of stone or it was carved out of the rock. The walls and roof of the tomb were plastered, and the plastering was in perfect preservation. We found nothing in the tomb but a little rubbish, and it had no doubt been entered before; indeed, the tombs throughout the Island have been diligently ransacked already, although I cannot doubt but that there are still some (perhaps many) undiscovered which may have escaped.

Of other classical work I found an ionic capital near Larnaka, and towards the western end of the Island, along the south coast, many marble columns and fragments of the same material. They are mostly about 18 inches diameter, of a dark-coloured granite; but the greatest number are situated at Paphos, towards the western end of the Island, where are remains

of what appears to have been the portico of a temple. Two of the columns of the portico and one of the flanking columns remain [Illustn. i, fig. 2]; they stand about 10 feet above the ground, and the lower part is buried. They are 30 inches in diameter at the base and about 20 feet high, of dark-coloured granite. Judging from the disproportionate thickness of the fillet at the top and bottom, they are late Roman. I had the lower part of one column uncovered, and found its base consisted of a torus moulding of white marble. There are also some sparse fragments of sculptured mouldings near this temple which are quite late Roman, and some fragments of corinthian capitals, one of which is at least sufficiently perfect to indicate that it is Roman corinthian. I noticed also at Paphos a range of fragments of columns, two of dark coloured granite and two of Cipolino marble; they were embedded in the earth, which I caused to be excavated sufficiently to expose the lower part of one of the buried shafts, but I found there was no base to the frustrum, and that it stood on made ground. They were moreover irregularly spaced, and I judge they are not *in sitû*. There are many scattered fragments and, particularly near the fort, many frustra of columns, which appear to have been overturned by the action of an earthquake. They are all dark grey granite, and all of much the same size. Besides these granite columns there were a few of almost black marble, fluted spirally. More than one column of similar form and shape I noticed built into the wall of the Greek convent at Ai Katharina, near Salamis. I observed also in other places fragments of corinthian capitals much defaced; I do not think they are either Roman or Greek, but probably of the byzantine period, about the sixth or seventh century. There are remains of late Roman work not only in the temples or rather columns of Paphos, but at Nikosia columns also exist, one or two of which stand erect near the Government House, carrying doric capitals of the renaissance character; and there is an arcade at Famagousta in the Italian renaissance style, forming part of what are called the remains of the palace of the Lusignan kings, which must have been one of the latest of their works. The columns forming part of this arcade are probably ancient columns brought from the neighbouring Salamis, where there are also the remains of a large building which, I think, is Roman work, measuring 60 feet by 180; and, except that at one end the side walls narrow on both sides, it would form a perfect parallelogram. It seems to have contained a lower vaulted storey, as the springing of the arches is clearly traceable on both side walls. There are remains of ancient walls and of an aqueduct of Roman character, but of the fragments which cover the area of what appears to be the site of the ancient and once populous city of Salamis, not one stone is left standing on another. The stones are so small, consisting of broken weather-worn angular masses, containing from one to three cubical feet, that there is nothing whatever left but a vast extent of worn and broken masonry. All stones fit for building have, it is said, been transported to the neighbouring town of Famagousta.

Near Nikosia I visited some ruins which I attribute to the Roman period, of walls of considerable extent and of great thickness, sixteen or seventeen feet of solid masonry composed of huge stones. There are also remains of very large tanks, formed in the rocks, the stucco on the sides of which remains in perfect preservation. The inner face of the walls is tooled fair, but the outside, except where tooled round the joints, is worked rough. Besides these I noticed inclosing walls of great thickness, and composed of very large stones, close to Kouklia on the south coast, where also, I am informed, there are some columns and other

classical remains, worked into the walls of the modern town, of which unfortunately I was not aware at the time, and I therefore missed seeing them. Amongst other work of undoubted antiquity is a fine marble sarcophagus standing in the cloister of the Abbey of Bella Pais, of the best style of Greco-Roman work; it is very similar to one which I remember to have seen in 1836, close to the Temple of Theseus at Athens. It is a long marble sarcophagus with moulded capping and base, with fine pendants of foliage and fruit surrounding it. There are some of a similar kind in the Vatican [Illustn. xvi, fig. 55].

At Kouklia, which was the official residence of the Roman proconsul Sergius Paulus, the Chevalier di Cesnola records that he was able to trace the site of the great Temple of Venus. He found that it was 221 feet long by 167 feet wide, surrounded by an outer wall or peribolos; he found portions of a mosaic pavement in the temple, and several large pedestals of colossal statues with Greek inscriptions engraved upon them, and he considers that the building which existed was anterior to the time of the Emperor Vespasian, and that it was repaired by him. The situation of this temple is very commanding, and enabled it to be seen many miles from the sea, from which it is not far distant. There are considerable remains of the outer walls which formed the boundary of the precincts of the temple, but I could not myself trace the temple. Here, as at Salamis, the ground is thickly strewn with stones, so worn and broken as to leave no sign of their having been stones used for building; for, except that they are not rounded, they more resemble the talus of a glacier than fragments of a ruined building.

Of Italian renaissance work, there is an excellent example in the gateway leading from the harbour of Famagousta into the town [Illustn. i, fig. 1]. The fortresses of Famagousta, Nikosia and Kerynia are fine specimens of mediæval fortification, and they remain in a very good state of preservation. At Kerynia there are some flanking towers which are outside the fortress; the stones on the outer face of one of these circular towers is left rough—what we call rustic work—and it was pointed out to me as evidence of greater antiquity than the masonry of other parts of the walls. It resembles the masonry of the gigantic walls which I saw near Nikosia, which are, I think, pre-mediæval, but I am not at all convinced that this is the case with the outworks of the fortifications at Kerynia.

The most interesting architectural feature in Cyprus is a very fine group of mediæval churches, which must belong to the time of the Lusignan kings, who reigned from the end of the twelfth to the end of the fourteenth century. These churches exist at Nikosia and Famagousta; the Turks have used some as mosques and some as storehouses, so they have been tolerably well preserved, with the exception of the glass which has been nearly all removed, and the sculptural images which have been defaced. This is particularly the case at Nikosia which is now the capital town of the Island, containing the cathedral or church of St. Sophia, the church of St. Catherine, and a third (on the south side of the cathedral) the church of St. Nicholas, the interior of which I failed to see. Both the two first-named are now used as mosques, and St. Nicholas church is used as a store-house for grain. None of these, nor of the churches I saw at Famagousta, have any transepts; nor is there any triforium over the aisle arches, the peculiarity in their construction being that they never had any roof or covering other than the stone vaulted roofs by which the nave and aisles are covered. The French architects by whom these buildings were designed, and under whose charge they were built, evidently found all

the buildings of the surrounding country as they now are, covered with flat roofs, and they adopted them—although they in other respects scrupulously built in the style of their own country.

The cathedral of St. Sophia at Nikosia is a remarkable work. The east end is semi-circular inside, semi-octagonal outside. The nave is divided into six bays, and the east end into five. The columns are circular with octagon bases. The pavement is of stone. There is a grand porch at the west end, 12 feet 6 inches wide between the columns. There are two western towers both of which are unfinished. The northern one is the more perfect, and it was evidently intended to have been carried a storey higher. The style throughout is the Decorated. There is distinct intimation, by the masonry on the south side of the north tower and also in the south tower, that it was intended to prolong the building up to the western face of the porch, but whether the nave above the porch was to have been prolonged, or whether a covered upper storey was intended to have been formed over the porch, I find it difficult to offer an opinion. However that may be, the existing west window is of itself complete; although I noticed that its tracery is not so purely and well designed as the window openings in the body of the church, and especially the fine windows of the northern unfinished tower of the west front. This church has the peculiarity of a door being formed at the east end* and one also on the north side, both of which appear to have been made after the original construction was completed. The masonry of these doorways is in marble, but the architectural details correspond very closely with the rest of the work; some of the enrichments in the deeply recessed doorways in the west front are also apparently of later work than the rest of the church; they are similarly in veined marble, the body of the church being of a fine hard limestone. There are chapels on either side of the church, and on the north side and at the west end are two lofty minarets built by the Turks [Illustns. vii, viii, figs. 26-29].

The church of St. Catherine, at Nikosia, now also used as a mosque, is a vaulted building, consisting of nave only; it measures 58 feet in length, and 27 feet in width, and I calculate the height to be about 52 feet. The nave has vaulted compartments; the east end is semi-octagonal; there is a small rose window at the west end; the side and end windows are of the best style of the decorated period; there is a fine south door [Illustn. x, fig. 37] and a fine western door. The buttresses are masked by converting them into semi-octagonal projections. There is a small building on the north side communicating with the church, and over this are some rooms. There is also a door on the north side, and there are traces on this side of the church of low buildings or a covered gallery next the church, and in the gardens adjoining on the north side of walls, which indicate that there was either a cloister or another building, probably conventual, extending beyond the church. On the south side of this church, at the west end, a lofty minaret has been added [Illustn. ix, figs. 33-36].

Of the church of St. Nicholas at Nikosia, standing close to the south side of St. Sophia, owing to my not having been able to see either the interior or the south side, I am unable to give any accurate account. It extends about 130 feet in length; it has three eastern apses and an octagon tower and dome above the roof, about the middle of its length. It has three

* By a letter, dated 4th March 1883, from Nikosia, I am informed that "there appears to be little doubt, from careful examination, that this doorway was inserted during the Turkish occupation, and after the church was used as a mosque, although christian workmen were probably employed."—E. I'A.

fine doorways on the north. In style it is, I think, later than St. Sophia, and the mouldings and decoration of the doorways greatly remind me of the details of Roslyn Chapel in Scotland.

At Famagousta the remains of churches are numerous, and that used as the mosque (originally the cathedral,* and dedicated to St. Sophia) is well preserved, although it was considerably injured by a Venetian bombardment. The columns, as at Nikosia, are circular. The nave is divided into seven bays. Each aisle has an eastern apse, and on the south side of the aisle apse is the *piscina*, still perfect. There are recesses in the walls of the north and south aisles. The western end is terminated by two fine towers, with a fine triple doorway [Illustn. ii, fig. 7]. There is no open porch as at Nikosia, but there are chapels on either side. The style is later than that of the cathedral at Nikosia. There are many ruins at Famagousta of other fine churches, which are said to be twenty in number, but I could not learn the names. On some of them the fresco paintings still remain wonderfully well preserved; amongst others I noticed a fresco of St. George and the Dragon, but the style of the frescoes is not good. In one of the half ruined churches, of which the remains of the east end, with its triple apse, are very considerable, I observed the haunch of the arches of the roof confusedly filled-in with large hollow pots, as if for the purpose of lightening the construction [Illustn. iv, fig. 17].

There is another religious mediæval building at the back of the Island, near Kyrenia, of singular interest, and in great part wonderfully preserved, called the abbey of Bella Pais. It stands on the side of a mountain, in a most beautiful situation, overlooking a fertile plain below the distant mountains of Asia Minor and the intervening sea. On the south side of the group of buildings, of which the abbey consists, is a church having the plan of a Greek cross. On the north of this is a cloister, three sides of which still remain, and which inclosed a court. North of this cloister is a noble hall lighted on the north side by windows commanding a lovely view, and at the west end by a rose window; below this there is another of the same size, divided into two compartments. Upon the lintel over the south door of the great hall are sculptured three shields: one represents the Jerusalem cross, another the royal arms of the Lusignans, and the third a lion rampant [Illustns. xiii-xviii].

There are other ruins of mediæval and renaissance work, both ecclesiastical and military, in the Island, and some of them are considerable in extent and most picturesquely situated. There are extensive remains of castles at Kouklia, one very perfect at Episkopi, some near Larnaka, and some in the town of Nikosia. Several mediæval doorways may be seen in the narrow streets around the cathedral of that city. One doorway I saw must, from the general character of its mouldings, be late sixteenth-century work, where the norman chevron is used in the decoration of the arch; and the same thing I noted in the arch of one of the doors in the abbey of Bella Pais, the general architecture of which is excellent decorated work. I have observed the same use of this norman decoration in arabic work even of the present day [Illustn. x, figs. 38, 39].

There are some interesting and graceful specimens of arab architecture, domed churches with porches having pointed arches, but these are on a small scale. The domestic architecture left by the Turks is a combination of arabic and "Louis Quinze," but however impure their

* I learn that the authorities are just about to repair the roof of this church and to prop-up the north-west tower, the sum of £300, to be probably increased to £500, having been granted for the purpose.—E. I'A.

works, they seem to be especially skilful in the construction of stone arches; and in their arched work of the present day the Cypriotes still continue the same. Their roofs are all flat, covered with clay and chopped straw, and although not absolutely waterproof, the comparative dryness of their climate makes these roofs practically sufficient.*

This is of course not the place in which to discuss the political aspect of our connection with the Island of Cyprus, but Monsieur L. de Mas Latrie, dedicating in 1878 a very interesting little book on the situation of Cyprus† to Sir Austen Henry Layard, then English Ambassador at Constantinople, and one of our own members, addressed him in these words:—" Vous " donnez à la Couronne d'Angleterre une des plus belles îles de la Méditerrannée, sans que " l'Europe puisse en concevoir de l'ombrage. Vous offrez à la Turquie une voie de salut " inespérée, en lui apprenant ce qu'elle n'a jamais su: l'art de gouverner paisiblement ses " conquêtes."

[Notes communicated by Sydney Vacher, *Associate.*]

I landed at Larnaka in 1882, and thanks to Sir George Kellner, K.C.M.G., who had given me an introduction to H.M. Commissioner, Mr. Cobbet, I was able to start on my journey through the Island the next day, and to the latter I owe the success of my visit. I arrived at Famagousta after a long day's travelling on mules at three miles an hour, and put up at a Greek house in the adjoining village. The building that interested me most was the cathedral, of which I have some illustrations [ii & iii, figs. 7-14]. In that of the west front I have omitted a building about 25 feet square, situated against the south turret of the west façade; it is an excrescence, and evidently much later in date, its details having been coarsely copied from the cathedral. There are also remains of buildings on the north side of the cathedral. I traced a building that might have been a hall, 36 feet 6 inches long and 19 feet 6 inches broad, with about sixteen external steps up to the doorway, only part of one jamb of which remains. This hall is situated on the north side of the cathedral, parallel with it and level with the first two bays; it is about 40 feet off. Again, on the north side of this are a series of small rooms, two of them leading off it; they are about 15 feet square, and abut on the main street leading from the Water Gate, of which Mr. I'Anson speaks as being a fine piece of renaissance work. They have shops underneath them—that is to say, vaulted chambers, with an arch and a door to the street. They have undoubtedly been mediæval shops, extending either way, and I have notes of nine. At the north-east end of the cathedral, against the building I take to have been the sacristy, are the remains of what at first appears to have been

* My kind correspondent, before-mentioned, writes that the covering for these flat roofs is done as follows:—" The spandrils of the arches are filled-in with rubble masonry, the upper surface is levelled, and the whole is covered with a coating of fine concrete, composed of one-third lime, one-third small grit or pebbles not exceeding a quarter of an inch diameter, and one-third broken tiles in small pieces about the size of the pebbles. After being spread, the upper surface is rubbed over and over again with a trowel until a fine hard surface is obtained. The whole is then covered with an inch or two of earth, to protect the surface from the powerful action of the sun until the lime is thoroughly set. The object of the broken tiles is to impart a certain amount of hydraulicity to the lime."—E. I'A.

† *L'Ile de Chypre sa situation présente et ses souvenirs du moyen-age*, par M. L. de Mas Latrie, Professeur à l'École Nationale des Chartes, Chef de Section aux Archives Nationales—Paris, 1879. This excellent description of Cyprus is, in part, an abridgement of M. de Mas Latrie's larger work entitled *Histoire de L'Ile de Chypre sous le règne des Princes de la Maison de Lusignan*—Paris, 1861.—E. I'A.

a well, but I believe it is a staircase leading down to a crypt placed at least 15 feet below the floor of the cathedral. It would well bear investigation, and probably would bring some mediæval treasures to light.

The two chapels on the south side are both interesting; in the westernmost one [Illustn. iii, fig. 12] I found, under the three-light window, a painted inscription introduced into the decoration. The whole wall had been whitewashed, and, aided by a penknife, I discovered it piecemeal, thus :—

ARRIFICUS · FILIUS · QUODAM · D ·
RICARDI · QUI · AD · H
ANNO · DNI · MCCCLXXXIIII · DIE ·
PACE · AMEN

On the boss at the intersection of the vaulting is a shield surrounded with a wreath of roses; the arms are those of Jerusalem—viz., a quarter-pierced cross crosslet between four crosses patée. The next chapel is now used as a goat-shed. It is undoubtedly a memorial chapel, and on the south wall is the top of a canopied tomb, but I was unable to get at it, as there are 10 feet of rubbish against it. This chapel has also a coat of arms on the boss of its groining—viz., a plain fess on the shield.

I found in the church two mediæval iron candlesticks, very much knocked about, and still used by the Mohammedans. I give a sketch of one in Illustn. iii, fig. 9. But the most interesting relic is the inscription cut in face of the buttress on the west side of the south door; it gives the date of the church as August 1311*—that is, during the long reign of Henri II. This

* I think it may assist those who are sufficiently interested in this subject to add to the notes which Mr. I'Anson and I have made upon the mediæval remains in the island, if I give some lengthened quotations from the first chapter of the official work on Cyprus, compiled in the Quartermaster-General's Department, Horse Guards. Starting at page 10 of this excellent book, I append an abridgement of the History of Cyprus from the end of the twelfth century to the present time, as follows :—

"In the year 1191, we find King Richard I. of England on his journey from Messina to St. Jean d'Acre, where he had appointed to meet King Philip of France, and to co-operate with him in the third crusade. On the fourth day of the voyage, a violent storm came on from the south, which dispersed the fleet, and the King reached Rhodes with difficulty. Three of his largest ships were driven upon the south coast of Cyprus, and the crews and soldiers were robbed, maltreated, and thrown into prison at Limasol. The ship which contained King Richard's sister, Queen Dowager of Sicily, and his *fiancée*, Berengaria, daughter of the King of Navarre, was driven by the storm towards Limasol, and gained the roads, but was refused entrance to the port, and had to anchor in the open roadstead.

"Isaac Comnenus arrived that day at Limasol, and tried to entice the royal ladies to come on shore; but they, suspecting treachery and violence, refused the invitation, which was vehemently repeated, and again declined; preparations were made to seize the ship, which was consequently obliged to set sail, and shortly fell in with King Richard and the remainder of the fleet.

"Provoked by Isaac's conduct, and refusal to give up the prisoners, or to water the fleet, Richard determined to disembark a portion of his force at Limasol and take vengeance. He found the port closed by sunken ships and other impediments, so the troops were rowed in galleys a short distance along the coast to a place where the shore was low and suitable for landing, and here he disembarked, and advanced upon Limasol. The Latin inhabitants of the town at once opened their gates to him, and informed him that Isaac, with the Greek army, had retired to the hills. Eventually a meeting took place between Richard and Isaac in the English camp, and the King expressed his surprise at the inhospitable treatment which his followers had experienced, reminded Isaac of his duty as a Christian prince, and concluded by asking him to join in the crusade, and throw open the island for the purchase of provisions. To all this Isaac at the time agreed, but after leaving the King's presence he changed his mind, and rejoined his army at Kolossi, whence he sent a message ordering the English to leave the island at once, or to take the consequences. Indignant at this falseness and arrogance

inscription owes its preservation to the fact that the gurgoyle that carried-off the water from the top of the south door came out of the middle of it. On this gurgoyle breaking-off, a shrub grew in the hole, or more probably the shrub took possession of the hole, and broke-off the gurgoyle—at any rate, it has kept the inscription as sharp as if it had left the carver's hands only yesterday [Illustn. iii, figs. 13, 14].

My sketch of the west façade [Illustn. ii] is made from my measured drawings, and I have authority for every bit of detail. The turret on the north side has been built up from the top

Richard now resolved to delay his crusade for a time and punish Isaac; he therefore at once disembarked his cavalry, marched against the Greeks, vanquished them, and shortly re-entered Limasol with a large quantity of booty. Amongst other trophies gained on that day was the Imperial Standard, which was subsequently deposited in St. Edmund's Chapel, in the county of Suffolk.

"The arrival in Cyprus at this juncture of Guy de Lusignan, ex-king of Jerusalem, accompanied by the Princes of Antioch and Tripoli, caused a temporary suspension of hostilities, and on the 12th May, 1191, Richard, in the presence of his distinguished guests, celebrated his marriage with the Princess Berengaria, who was crowned Queen of England by the Bishops of York and Evreux. Hearing shortly afterwards that Isaac had re-organized his army in the interior, Richard set off with the main body of his forces to attack him, and sent the fleet round to Larnaca to co-operate. In consequence probably of the fact that the geography of the island was at this time but imperfectly known, the subsequent operations are not very clearly related by historians; it appears, however, that Guy de Lusignan was detached with a portion of the troops to Famagusta, which town he occupied without meeting with any resistance; Isaac having taken up his position in the Messaria Plain, near Tremithoussia, a place very suitable for cavalry movements. Richard quickly followed him to this spot and gave battle; the Anglo-Norman army attacked with great impetuosity, and for some time victory wavered. Isaac, anxious to encourage his followers, threw himself into the thickest of the fight, and encountering the King of England, struck at him with his battle-axe; he was, however, soon surrounded dragged from his horse, and made a prisoner. Isaac's capture completed the discomfiture of the Greeks, who dispersed in all directions, without a thought for the defence of Nicosia, which town surrendered without resistance, and tendered its allegiance to King Richard. If the historians of the time are to be believed, the King, as a mark of his supremacy, then ordered the Cypriotes to cut off their beards.

"The chief towns being now occupied, it only remained to reduce the strong castles in the north of the island, which would otherwise form places of refuge for the few Greeks who had not surrendered. Richard, being detained by illness at Nicosia, intrusted this task to Guy de Lusignan, who was a prominent figure in all the operations of the conquest of Cyprus. The castle of Cerinea was the first attacked, it soon capitulated, and Isaac's wife, daughter and treasures fell into the hands of the English. Lusignan then marched against Fort St. Hilarion, which, after a brave resistance, was also forced to capitulate. Shortly afterwards the castles of Buffavento and Kantara opened their gates to Richard himself, and the subjugation of the island was then complete. [The castles of St. Hilarion, Buffavento and Kantara are situated on the highest peaks of the range of mountains that extend along the northern shore of the island. These castles were no doubt immensely stronger in the time of the Lusignan kings; but as I saw their remains, they seemed impregnable. They are perched round the summit of the highest peak, with their walls in most cases 50 to 60 feet perpendicular from the slope of the mountain, and their entrance, besides being steep and with the ordinary steps and drawbridge, was guarded with bastions in which were innumerable galleries for archers.—S. V.]

"Richard was now able to turn his thoughts to his neglected crusade; he returned to Limasol and sent Isaac's daughter, with his own wife and sister, on before him to St. Jean d'Acre. On the 5th June, 1191, Richard himself sailed from Cyprus, leaving the island in charge of Richard de Canville and Robert de Turnham, with injunctions to keep the army in Syria well provided with provisions.

"Isaac was placed in silver fetters and taken with King Richard to Syria, where he was handed over to the Hospitallers, since Knights of Rhodes, for safe custody, and was by them confined in the castle of Margat near Tripoli, where he died shortly afterwards.

"Several insurrections subsequently occurred in Cyprus, but were all suppressed by the decision and prompt action of Robert de Turnham.

"The Templars now entered into negociations with King Richard for the purchase of Cyprus, and they eventually obtained it from him for the sum of 100,000 Saracenic golden besants; it was further arranged that

stage, forming a tall minaret half as high again. This cathedral has several features peculiar to Cyprus: 1, the circular piers of the nave arcade, which are 5 feet 4 inches in diameter, and their caps are so small that they seem almost out of proportion; 2, there never has been a wooden roof, but the vaulting has been well cemented over and the water carried from the pockets by channels on the top of the flying buttresses. If a careful search were made of the floor, many valuable inscriptions and body-stones would be found. Two of these are shown in fig. 10; one is a charming fourteenth-century civic costume. I should add that in sketching I laboured

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40,000 besants should be paid at once, and the remainder as soon as it could be derived from the revenues of the island.

"The Templars ruled Cyprus for a time with a heavy hand, and their government became highly unpopular amongst the inhabitants, who continued in a perpetual state of revolt, causing so much annoyance and trouble to their masters, that in May, 1192, the Templars, finding that the popular feeling was entirely beyond their control, were compelled to entreat King Richard to take back the island, and they begged that the price which they had paid for it might be returned to them. Richard expressed his willingness to take over the island, but refused to return the 40,000 besants. King Guy de Lusignan now came forward, and, having arranged with the Templars that in the event of his being made King of Cyprus, he would refund to them what they had paid, went to Richard, and asked him for the island as compensation for the loss of the crown of Jerusalem, engaging also to pay the same sum that the Templars had agreed to. This offer was accepted and Guy intrusted to his chancellor, Pierre d'Engoulesme, Bishop of Tripoli, the task of raising the money. The sum of 60,000 besants was collected by means of loans from the citizens of Tripoli, and from the Genoese, and was paid by Guy to Richard, who asked for the remaining 40,000 besants, but Guy then pleaded poverty, and it is stated that the English King did not urge this claim further.

"Guy de Lusignan at once took possession of the island (May 1192) but it appears according to M. de Mas Latrie, that he never actually assumed the title of King of Cyprus. His reign was but short, lasting only one year and eleven months, but from all accounts he governed wisely and restored order and tranquillity in the island. One of his first measures was the introduction of a feudal system, and he endowed with portions of land, according to rank, about 300 knights and 200 esquires, who formed the nucleus of the nobility and privileged bodies in Cyprus.

"Guy was succeeded by his son Amaury de Lusignan. The following table gives the names, titles, and the duration of the reign of the Lusignan Kings of Cyprus.

No.	Name.	Title.	Date.
1	Guy de Lusignan ...	Ex-King of Jerusalem. First Latin Lord of Cyprus	May, 1172 to April, 1194.
2	Amaury de Lusignan ...	King of Cyprus and King of Jerusalem	April, 1194 to April, 1205.
3	Hugh I. de Lusignan ...	King of Cyprus	April, 1205 to Feb. 1218.
4	Henri I. de Lusignan ...	King of Cyprus. Lord of the Kingdom of Jerusalem	March, 1218 to Jan. 1253.
5	Hugh II. de Lusignan ...	" "	Jan. 1253 to Dec. 1267.
6	Hugh III. d'Antioche-Lusignan	King of Cyprus and King of Jerusalem	Dec. 1267 to March, 1284.
7	Jean I. de Lusignan ...	King of Jerusalem and of Cyprus	March, 1284 to May, 1285.
8	Henri II. de Lusignan ...	" "	May, 1285 to March, 1324.
9	Hugh IV. de Lusignan ...	" "	March, 1324 to Nov. 1358.
10	Pierre I. de Lusignan ...	" "	Nov. 1358 to Jan. 1369.
11	Pierre II. de Lusignan ...	" "	Jan. 1369 to Oct. 1382.
12	Jacques I. de Lusignan ...	King of Jerusalem, of Cyprus, and of Armenia ...	Oct. 1382 to Sept. 1398.
13	Janus de Lusignan ...	" "	Sept. 1398 to June, 1432.
14	Jean II. de Lusignan ...	" "	June, 1432 to July, 1458.
15	Charlotte de Lusignan and Louis de Savoie ...	King and Queen of Jerusalem, Cyprus and Armenia	July, 1458 to Sept. 1460.
16	Jacques II. de Lusignan .	King of Jerusalem, Cyprus and Armenia	Sept. 1460 to July, 1473.
17	Catherine Cornaro & Jacques III. de Lusignan	King and Queen of Jerusalem, Cyprus and Armenia	July, 1473 to Feb. 1489.

There is but little of historical importance to relate concerning the three centuries during which Cyprus

under many disadvantages. Indeed I was only allowed to roam about the roof of one church (now a mosque) as I did, by the wholesome fact that the morning I arrived two or three scoundrels, who had been caught red-handed from murder, had been hanged. The natives however squared matters with me, for eventually, while my back was turned and I was taking a dimension at the other side of the building, they looted my measuring rod, sketching stool and several other valuables, though not a soul was to be seen either before or after the occurrence.

Parallel to the cathedral on the south side, about six or seven hundred yards off, are the remains of a large church, marked A [Illustn. iv, figs. 15-19]. It is curious in plan; the nave

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was ruled by the Lusignan dynasty: internal tranquillity, a state of affairs which had hitherto been almost unknown in the island, prevailed throughout nearly the whole period, with the two exceptions mentioned below, and consequently the kingdom was generally in a flourishing condition; at the same time some distinction was gained against the Arabs and Turks. In 1372, an untoward incident occurred; Pierre II was then King of Cyprus, and whilst he was entertaining several Genoese and Venetian grandees on a festival day, a quarrel with regard to precedence arose, and was decided by the King against the former. It is said that the Genoese then plotted against the King's life, and that their intentions being discovered, it was ordered that all the Genoese subjects in the kingdom should be put to death. This monstrous command was only too faithfully obeyed, and the Republic of Genoa, in order to avenge the murder of her citizens, despatched at once a considerable fleet to Cyprus under the command of Admiral Pietro Fregoso, who, after several engagements, took Famagusta in 1373, and carried off Jacopo Lusignan, the King's uncle, and Lieutenant-Governor of the island. The Genoese continued to hold and garrison Famagusta, strongly fortifying the city in order to ensure their grasp on the island, and they exercised supremacy there for no less than ninety years, when King Jacques II., with the aid of the Egyptians, retook the place.

"In 1425, Cyprus was invaded by an Egyptian force which first took Larnaca, then Limasol, and subsequently ravaged almost the whole island. King Janus was carried off a prisoner to the Sultan at Cairo, but after paying a ransom and promising that Cyprus should send an annual tribute to Egypt, he was liberated, and allowed to return to his kingdom as the lieutenant to the Sultan.

"King Janus died in 1432; he was succeeded by his son Jean II., who married Helena Paleologos, niece of the Emperor of Constantinople, and their daughter, Carlotta, was now the only legitimate descendant of the Lusignans. King Jean, however, left a natural son, named Jacques, who was Archbishop of Cyprus. Carlotta, on the death of her father in 1458, became Queen of Cyprus; she had married, first, one of the sons of the King of Portugal, and secondly, Louis de Savoie, who, with her, governed Cyprus under the titles of King and Queen of Jerusalem, Cyprus, and Armenia. Their reign was, however, but short, for in September 1460, Jacques, 'Le Bâtard,' who was a man of great ability, and highly popular with the Cypriotes, headed a revolt against their authority, seized Nicosia, the capital, and then with the assistance of the Sultan of Egypt, forced the King and Queen to fly from the island; he was immediately proclaimed King, with the title of Jacques II., and before dismissing the Egyptian troops, he captured Famagusta from the Genoese. This exploit greatly increased his popularity amongst the natives, to whom the presence of foreign troops holding one of their chief cities had been very galling.

"Thus Queen Charlotte was the last legitimate successor of the Lusignan Kings; she became a widow in 1482, and abdicated in favour of her nephew Charles I., Duke of Savoy, on the 25th February, 1485; she died at Rome on the 16th July, 1487.

"King Jacques II., in order to strengthen his position, allied himself with the Venetian Republic, and, in 1472, married Catherine Cornaro, a daughter of one of the noblest Venetian houses. This union was fated to last but a very short time, for in July 1473 King Jacques died, leaving Catherine to direct the kingdom in the interest of their unborn heir. Two months later Catherine gave birth to a son, who received his father's name, and was crowned King Jacques III., but in August, 1474, this infant king died, and Catherine then reigned alone for about fifteen years. . . . .

"The last descendant of the family of Queen Catherine of Cyprus, and the last direct representative of the Cornaro house, was M. Catherino Corner, who died at the beginning of this century. He bequeathed the splendid Saint Cassien Palace to Pope Pius VII, who united it to the pontifical property. Gregory VII gave it to the Abbés Cavagnis, who afterwards ceded it to the Venetian municipality, and it is now the 'Mont de Piété' of Venice. . . . .

consists of five bays, divided by circular columns 4 feet 7 inches in diameter and 49 feet 6 inches wide from centre to centre of columns. The centre bay is square, and this probably had a dome over it. In each bay of the aisle there are (where doors do not come) the remains of a wall tomb. This seems to have been a favourite arrangement, though I did not see traces of any in the cathedral. At the east end of this church are three semi-circular apses, also a favourite plan in Cyprus for churches of this date. I may say it is the more general form of all the mediæval churches in the Levant, and also of those along the east coast of Italy, for they were all raised under the patronage of the Crusaders. In Italy I allude to

"On the 28th March, 1474, the Senate decided that forthwith two Venetian counsellors and one proveditor should reside in Cyprus, to assist the Queen in the government and to command the forces of the Republic. . .

"During the Venetian rule the island was divided into eleven districts, some governed by captains, others by 'civitains:' the towns of Nicosia and Famagusta were placed under Cypriote Viscounts (Sheriffs) as in the time of the Lusignans. The districts were—Baffo, Avdimu, Limasol, Mazoto, Saline, Viscontado, Messaria, Carpasso, Cerinea, Pentagia and Khrysokho. . . . .

"The tenure of Cyprus by the Venetians may be described as simply a military occupation, and as no measures for its proper maintenance were taken, the prosperity of the island visibly declined throughout the whole period; trade languished, manufactures almost ceased, landowners abandoned their property, schools closed, the population emigrated, cultivation was neglected, the streams were allowed to overflow and form infectious marshes, and the national wealth rapidly diminished.

"But the greatest calamities that threatened Cyprus were the increasing power of the Turks, and the advance that they were making both in Asia and Africa, so we now pass on to the time at which they invaded and obtained possession of the island.

"It appears that after the subjugation of Egypt by the Sultan Selim I in 1517, the tribute which, since 1425, had been regularly paid by Cyprus to the King of Egypt, was then annually sent to the Sultan of Turkey instead, and with this arrangement the old chroniclers say that 'they (the Turks) held themselves well contented.' Solyman the Great was, however, succeeded on the 25th September, 1566, by the ignoble and degenerate Selim II, to whom his own national historians give the epithet of "the fool," and in 1570, the self-willed cupidity and violence of this prince involved the Porte in a war with Venice for the acquisition of Cyprus, the possession of which island Selim had coveted, whilst he was governor of Kutahia in his father's lifetime. . . . .

"Hostilities were commenced in February, 1570, when an army was sent into Epirus, and to the frontiers of Dalmatia, to overrun Venetian territory, and to attract the attention of the Republic away from Cyprus; and further, in the middle of April, a fleet of eighty galleys and thirty galliots, under Piall Pasha, was sent to sea to prevent aid being despatched from Venice to Cyprus, and to secure the uninterruption of the invasion of the island. . . . .

"On the 1st July, this fleet cast anchor in the roadstead of Limasol, and the disembarkation of the troops was, owing to the negligence and incapacity of Nicholas Dandalo, who commanded the Venetian force on the spot, effected without opposition or loss; the fort of Leftari, near Limasol, also surrendered at the first summons. The Turkish army now entrenched itself, and a council of war was held to determine whether Famagusta or Nicosia should be the next object of attack. The great heat, and the unhealthy situation of the former town at this time of year, caused the decision to be in favour of an advance against Nicosia, which was the capital of the island, and centrally situated.

"Nicosia was then strongly fortified; the old defences had been only recently demolished by the Venetians new and strong walls, having a circuit of three miles, had just been constructed, and the place converted into regular fortress with eleven bastions and three gates; the walls were defended by 250 pieces of artillery.

"The garrison appears to have consisted of from 8000 to 10,000 men; of which number 3000 were Venetians, 2500 native militia, 1500 Italians, 1000 nobles of Nicosia, together with Albanians and others.

"On the 22nd July, Lala Moustapha reached the neighbourhood of Nicosia, and encamped his army within one and a half miles of the walls. It is reported that he had with him 2500 cavalry and 50,000 infantry, with which force he commenced a regular siege of the fortress, the troops constructing trenches and batteries with the greatest activity. The operations of this siege, which lasted seven weeks, are well described by Knolles in his *General History of the Turks*, page 848. At the beginning of September, the investing army received a

the churches prior to the thirteenth century at Brindisi, Bari, Bitonto, Bitetto, Trani and Foggia. Bari cathedral has a dome over the crossing, and this, and the dome construction in Cyprus, I think, come from the East. The smaller church at the side [figs. 16, 18] I take to be the earlier church, possibly prior to the Lusignan occupation. It has one dome, that of the south-east corner, raised one storey above the top of the arches, and this storey has single-light windows in it. The construction is worked on Saracenic principles. This small church is a type of several in Famagousta, and in several instances such buildings have been converted by the Turks into baths. For this purpose flues were constructed along the floor, and the domes were pierced with a number of holes, in which earthenware pots like small drain pipes were fixed. The arrangement of the cells between the apses at the east end of the large church is peculiar.

There is another church about the same date, possibly slightly later; it is situated opposite the Government offices, and is used as a store. I have marked it B [Illustn. v, figs. 20, 21]. The interior arrangement is similar: a nave arcade of five bays formed by round columns. A couple of vestries have been arranged at the back of the semi-circular apses of the east end. The door is rich [fig. 21], and gives the date of the building about contemporary with that of the cathedral. The tympanum has evidently been removed, and the form is peculiar.

Through the courtesy of Mr. Lawrence I am able to give a drawing of a marble tympanum which was found at Larnaka while digging for the foundations of a house, and was sent over by Major Cesnola. It is a very interesting piece of work, probably of the eleventh or the early part of the twelfth century, as it is undoubtedly byzantine in character, and it is the only carved tympanum I have seen from the Island [Illustn. xii].

To the south of the cathedral is the ruin of a delightful little church, marked C in Illustn. vi, figs. 22-25. The plan is one ordinarily used, but the way the north turret is placed on the north-west angle is very clever [fig. 25]; the turret by which you gained access to the roof from the floor of the chapel must have been on the other side, and this one was doubtless merely for protection of any one passing round, and also for symmetry. The parapet of this

reinforcement of 20,000 sailors and marines, sent by Piall Pasha from the Turkish fleet, and on the 9th of that month an assault was ordered, the attack being chiefly directed upon the Podocataro, Costanza and Tripoli bastions.

"The struggle was long and sanguinary, but in the end the superior numbers of the besiegers prevailed, and the gallant defenders were forced back from the walls; the Turks then entered the city, and for eight days murder and pillage reigned supreme. It is said that 14,866 of the garrison and inhabitants perished on the 9th September, and that altogether 20,000 were killed, and 2000 youths and girls taken away as slaves. . . . .

"The neglected state of Cyprus prior to the advent of the Turks has been already alluded to, but the ill-fated island was now doomed to fall into a far worse condition, and the mismanagement of a Turkish administration was soon demonstrated by a rapid decrease in the revenue. Proof of this is contained in an interesting document by Bernard Sangrado, contained in M. de Mas Latrie's *Histoire de l'Ile de Chypre*, vol. iii. page 560, which compares the annual revenue and expenditure under the Venetians, with their amounts in the years 1575-85, during which period the Turks were in possession, and it shows a marked falling-off under the new rule. . . . .

"The last important event in the history of Cyprus is the transfer of the island to England by a conditional Convention entered into by Great Britain and Turkey on the 4th June, 1878." [Extracted from Major A. R. Savile's work, compiled in the Intelligence Branch, Quartermaster-General's Department, Horse Guards—London 1878.] I recommend all students who may go to Cyprus to provide themselves with this work, for it will help them in a variety of ways, and the historical portion of it will undoubtedly add interest to their researches among the ancient and mediæval remains. S. V.

chapel, which was used for defensive purposes, overlooked the harbour, and was loopholed for archers. There has been a wall tomb under an arch in each bay of the side walls. The tracery shown in fig. 23 is my restoration. Mr. I'Anson's sketch of another chapel in Famagousta [Illustn. i, fig. 4] shows a bellcot for two bells over the west end, and also two rows of corbelling as if there had been a porch attached at some time. He also gives a sketch taken from the ramparts above the Water-gate, showing the door to the fort, with the Venetian lion over it [Illustn. i, fig. 1].

The chapel marked D [Illustn. xi, figs. 40-45], situated halfway between Larnaka and Famagousta, has a desert of stones round it, and the remains of a well. It has remains of colour decoration, probably a Christ with attendant angels on the half dome, and a row of prophets underneath with painted niches over them. Each one carries a scroll. This building is typical of many in the Island, and probably belongs to the byzantine occupation. One a little later in date, but of the same style, is the ruin E [Illustn. xi, figs. 46, 47]: four walls covered with a painted barrel vault and a dome in the centre. In Famagousta there are two or three instances of remains of buildings parallel to one another, only a few feet apart. I think one might have been a chapel, the other a hospital attached, for undoubtedly there were many hospitals in the city. There are many remains of fresco painting, but they require careful study, and I had not sufficient time to bestow any upon them.

With the exception of the castle at Kantara I saw nothing more of architectural interest till I came to Bella Pais, where are remains of a perfect Benedictine monastery [Illusts. xiii-xviii]. The plan [figs. 49, 50] is like all such establishments, with the exception that, on account of the site, the cloister and consequently all the other buildings have been placed on the north side of the church instead of on the south. The church, like all other Benedictine monastic chapels, is cruciform in plan. On the east side of the cloister is a kitchen (?) and the chapter house, with the dormitory above. On the south side the refectory, and on the west side must have been, I think, the abbot's lodging and the hospitium, but only a few feet of the walling of these buildings remain.

The monastery is entered by the old gateway, exactly opposite the west door of the church. and about 70 feet distant. This gateway is curious; the string forming a gable over the arch shows the original outline of the gateway. The arch was corbelled out from the face of the boundary wall by three moulded corbels, as shown in fig. 51. Later on, the owners evidently determined to fortify this gateway, so they built up the stonework flush with the outside face of the corbels and arch, and built the superstructure; they must have had a big ditch, for undoubtedly there were drawbridges. There is a staircase behind leading to the top.

The church has a grand porch and a bell-turret formed in the gable of west wall, with a passage staircase up to it on either side from the walks over cloister. This staircase is formed in the thickness of the wall [figs. 49, 50]. At either end of the porch there are tombs under arches, and at the easternmost one in the south end, on the soffit of the arch, I found remains of Italian decorations: an Ecce Homo in the centre medallion, and quarter-length figure subjects in the others; the medallions are of the ordinary quatreform shape, with spikes at the angles, and the spaces between the panels are filled-in with foliage. Above the north end is a staircase, and this, I am inclined to think, was the abbot's private staircase from his quarters to his cell, formed over the vaulting of the middle bay of the aisle

[Illustns. xiii, xiv]. The church has a nave of three bays, the third being carried up beyond the vaulting of the aisles, and so forming the cross. Illustn. xv shows the interior of this church. The columns are circular, but the arrangement is like that of the nave at Much Wenlock Abbey in Shropshire, with the exception that at Bella Pais there is only the single column 4 feet in diameter, and the arcade arches and also the arches and diagonal ribs of the aisle vaulting spring from corbels on the face of it; the remaining one-third column is carried up and takes the spring of the nave vaulting ribs. The transepts have pointed barrel vaults, the design of which is ingenious and effective. The south door was for the lay outsiders, the north one for the monks; and from the porch of this north door a staircase led straight up to the dormitory. This I expect was used solely to reach the dormitory, for there is another one to reach the walk above the cloister vaulting from below, in fact, three altogether, one for the abbot and two for the monks. In the middle bay of the north aisle is a circular staircase leading from the church to a small cell, constructed over the vaulting of this bay only evidently for the use of the abbot. It has two cupboards, a door leading out to walk over cloister, and a small window looking into the church. There is a chapel on the north side of the chancel [fig. 49]; it has had its entrance so carefully built up that I was unable to trace where the opening came, but it must have been in the end wall of the aisle. I should say an investigation of this chapel would well repay the trouble. It could be entered by one of the windows, and in all probability many fine mediæval remains would be found. Possibly the hiding-place of some of the monastic property might be found here.

My reason for calling the building at the further end of the east side of the cloister the kitchen, is that there are remains of a large fireplace; and moreover, it is in the position one would naturally look for the kitchen. I think there is no doubt about the other being the chapter-house; it was divided into four by a centre column, and richly vaulted. The windows are richer in form than those of the kitchen. The room above was the dormitory, divided into seven bays by semi-circular piers against the wall that carried the vaulting ribs; it had a large window in the north wall, with a rose-window over [Illustn. xviii, fig. 58]. In each bay is to be seen a small window and a cupboard, also a small window above, as high as it was possible to get it to the soffit of the vaulting, showing, I think, that some regard was paid to the ventilation of the rooms; all the cupboards are formed in the wall, and have a rebate for the door. The passage at the south end of the dormitory is curious; unfortunately the east portion of it is broken away, but I think a convenience for the monks was constructed here. At the end of the east walk of the cloister is a door leading outside the monastery. As you turn the corner to the left is another door; this, I take it, was the service door to the refectory, which is situated along this side. The entrance to the refectory is rich [Illustn. xvi]; on the lintel of the door are three shields, with coats of arms blazoned on them. The centre one bears the arms of Jerusalem, a quarter-pierced cross-crosslet between four crosses *patée;* that on the left is blazoned quarterly, first and fourth a quarter-pierced cross-crosslet, second and third a lion rampant; that to the right is blazoned *barrulé*, a lion rampant.

I give a sketch of the interior of the refectory [Illustn. xvii]. It shows the pulpit from which one of the monks read at meal-times, and the entrance to the staircase leading up to it; the window of the easternmost bay, being richer (it is filled with tracery), and the seat at the

base of the angle vaulting shaft being higher, show that the daïs came here. I think that the stone seat went all round the walls. The Turks fitted up this building as a stable, which may account for some of the stone seats being cut away, and also for wood plugs and remains of fittings in the walls. Below it, is a crypt divided in two by a cross-wall, which has a door in it, and the whole is vaulted [Illustn. xiv, fig. 49a]. There is a row of octagonal shafts down the centre carrying the vaulting ribs. There is also a large external door in the east wall.

The cloisters have been very rich. I have given a sketch of the bay outside the refectory door; it is the only one in which the design of the tracery can be followed, as all the others are too much broken away [Illustn. xvi]. The Roman sarcophagus shown in this sketch is the one alluded to by Mr. I'Anson. The goats' heads at the angles are beautifully modelled, and the whole is a very refined piece of work, finer than most specimens of the same period preserved in the Italian or English museums.

The whole of the north side of the monastery is built on rock, which at the west end is some 20 feet high perpendicularly [Illustn. xviii, fig. 57]. At the west end there are remains of walls and window jambs, which I take to be ruins of the hospitium. The church I put down as one of the early Lusignan buildings; it is undoubtedly French in design, as shown amongst other things by some capitals I have illustrated [figs. 52, 53]. The rest of the monastery is much later, probably fourteenth or fifteenth-century work, and I think designed by the same architect that designed the western towers and porch of the Cathedral of Nikosia. I may here remark that this ruined monastery is carefully taken charge of by our Government; all external doors have been built-up and everything is under lock and key.*

In Nikosia, now the capital of the Island, I found the mediæval buildings mostly of a later date and many very debased, as if they were copied by native workmen from the buildings at Famagousta. St. Catherine's, of which Mr. I'Anson gives illustrations [figs. 33-37], is a good specimen of this class of work.

The cathedral is an immense building; it is the same width as the cathedral at Famagousta, except that it is 6 feet narrower across the nave from centre to centre of the columns. These columns are circular, they are 3 feet in diameter, and divide the nave into six bays,—the east end terminates in a five-sided chevret formed by much lighter columns, 2 feet 3 inches in diameter, with the aisles carried round; the effect is very good and makes the building much longer than that at Famagousta. The chapel on the north side was evidently the sacristy; it has an external doorway. It also has a small doorway into the church, besides the arch opening. There are two chapels on the south side, but I did not get into them. The aisle windows of the church are immense single lights, the glass line measuring 7 feet 6 inches. Mr. I'Anson gives a sketch of one [Illustn. vii, fig. 27]. I have a note to the effect that the four bays from the west end are later work. In Mr. I'Anson's sketch of the north side of the cathedral, one of the clerestory windows is shown [fig. 28]. The small gable over this window is probably accounted for by the window being placed so high up, that the vault would show above the string course, which acts as a cornice. The big six-light window in the west wall [Illustn. viii] has remains of this same little gable, showing that it finished

* I am assured by letters from Cyprus that scribbling on the walls is no longer permitted.—S. V.

like the others. The tower and porches at the west end are again of later work; I have given a sketch of them [Illustn. viii]. Curiously there has been an arcade or possibly an arch in front of the west window joining the towers. The porches are rich, the jambs and tympanums of the doors are of white marble elaborately worked. I should say at one time the niches had been filled with figures. Mr. I'Anson thinks that this work and the towers were never finished, but I am inclined to put down the ruins to the disastrous siege the city underwent at the hands of the Turks. This work is richer and has purer detail than any of the other, and I think that an architect from western Europe must have directed it.

Mr. I'Anson speaks of the church on the south side of the cathedral and parallel with it, and likens it to Roslyn chapel. The plan, like that of the two churches in Famagousta described by me, is oblong, covered with a barrel vault, with a dome in the centre. The rich parts, the entrance door and one or two windows, I take to be late additions. I was unable to get inside this building because it is now used as a Government store.

I was shown another interesting little building in Nikosia: the Armenian chapel which is fourteenth-century work. It contains under the altar remains of an interesting tomb, of undoubted mediæval Cypriote work [Illustn. ix, figs. 30-32]. There is also in the court-yard a fine early body-stone, with a recumbent figure of an abbess holding a pastoral crook; at her feet is a shield with a coat blazoned on it two luces or pikes. I have a note saying the western bay was altered in 1630. There are numerous inscriptions on the stones, body-stones or coffin-lids, with which the floor is paved.*

At Kolossi on the other side of Larnaka is the keep of a castle [Illustns. xix, xx] which is evidently a Lusignan building. On the east side of the keep, about twenty feet from the ground, I observed a panel [fig. 64] containing four shields with coats blazoned on them. The same arrangement, I am told, is to be seen over the doors of the Knights' houses in Rhodes. I noticed some other buildings belonging to mediæval times about fifty yards to the S.E. of this Tower but I could not get particulars of them. The arrangement of this keep is simple: a staircase in one corner and a cross wall parallel with the entrance side dividing the floors into two rooms; so that if the first was forced, they could retire into the second. Probably the ground and basement floors were used for stores and attendants. The main floor [figs. 59, 60, 62], seems to have been divided into two floors in height, as there are holes at the springing of the vault which evidently held beams, and possibly these upper apartments were used for sleeping purposes or for stores. The fireplace in one of these rooms is given in fig. 63. The slope [fig. 61] up to the doorway is part of the old one that took the drawbridge.

Near this, at the village of Episkopi, is a ruined chapel, in which the remains of the byzantine colour decorations can be traced. The chapel is only four walls, with a semicircular eastern apse. It is roofed with a pointed barrel vault, and has a dome over the centre bay, springing from a string course on the tops of the arches. There is a single-light window in the centre of the apse, just above where the altar would have come. The decoration from the floor to the level of the top of the altar has been painted drapery drawn with conventional fold; above this to the level of the top of the window, which is marked by a band of colour, is a space

* Some of these inscriptions I entered in my notebook, but M. de Mas Latrie has published them and many others in his smaller work. They will be found printed at page 31, and for remarks about them I must refer the reader to the book, the title of which is given on the next page.—S. V.

divided into an arcade painted with a figure holding a scroll under each canopy, like those in the little chapel D [Illustn. xi]. Above this is another broad band, capped by the string course from which the half-dome springs. In the centre of this is an empty throne, and on either side a row of communicants advancing to receive the communion. They walk one after the other, and the first one is receiving the element from the priest; the bread is being given on one side, the wine on the other. All the figures have the twelfth-century cloak fastened over the right shoulder; and they all have their hands, which are extended to receive the sacrament, covered with this cloak. On the vault are the remains of a Virgin and two adoring angels with incense. In the spandrils between the arches that support the dome are the four Evangelists, writing, with their attendant emblems; they are the same in design as those in the westernmost vault of the upper chapel of St. Francis Assisi. The lower ring of the dome has a band of saints and fathers of the church, and above them the space is filled with a host of adoring angels. There are traces of other decorations, but I regret I am unable to give drawings or a better description of them.

I hear there are remains of gothic buildings at Morpho, but unfortunately I was unable to get there. I am glad to say that some structural repairs are to be done to the cathedral of Famagousta, under the superintendence of an able English engineer. His Excellency the Governor has kindly sent me a copy of the engineer's report, and what is proposed to be done to the building is, I consider, absolutely necessary to prevent it from falling into further decay. I hear also that the mud hovels in front of the cathedral at Nikosia have been removed, and a large open space formed. These are only two of many signs of improvement due to the energy of Sir Robert Biddulph, K.C.M.G., under whose able government the mediæval buildings in Cyprus are certain to be in safe keeping.

SYDNEY VACHER.

[APPENDIX.]

*Some Inscriptions noted by M. L. de Mas Latrie.**

NIKOSIA.

CHURCH OF SAINT SOPHIA.

1. [Ci git . . . . . qui trepassa l'an . . . . . et git . . . . qui trespassa l'an . . . . au mois de] Novembre l'an M.CC.LV de Crist. Que Dieu . . . . la grace de leurs armes . . . . le paradis . . . . .

2. † Ci git dame . . . . de Giblet, fille de sire R . . . . de Giblet, seignor de . . . . . . digne feme de Franses Camardas, qui trespassa l'an de M.CCC.III. de Crist. a VI jours d'Octovre : Dieus ait l'arme.

3. Ici git sire Johan de La Remelle qui trespassa le jeusdi a XXV jours de Jenvier l'an de M.CCC.XXX. de Crist; que Des ait l'arme. Amen.

4. A. [Ici git . . . .] espouse jadis de maistre Nicole de Mantoua le M . . . . [qui trespassa l'an . . . .] VI, de Crist.

B. Et git soun fis Berteli (Barthelémy) Fardin qui trespassa . . . . .

C. . . . Fardin qui trespassa l'an de M.CCC.LXII.

5. † C[i git . . . . . . Que Die]u ait leurs armes. Amen.

6. A. . . . . . . e de . . . arsi . . d'Giblet . . . et Jorge de Brie . . . [qui tre]spassa le der[nier jour] de Setenbre à M.CCC.LXXII. de Crist; que Des ait l'arme.

B. † Ci doit jesir s. Hugue de Labre quant Dieu [fera de lui] son comandement.

7. [Ici git . . . . .] D . . . es jadis fille de [Pierre de C[afran, tres noble amirail dou roiaume de Chipre, qui trespassa le merdi à 11 jours d'Avril l'an de M.CCC.XCIII. de Crist.

9. † Ci git messire Johan de Joselin . . .

10. † Ici git le tres noble baroun messire Pierre L[e Jeune], le grand amirail, [qui trepassa l'an de . . . . . que Dieu] ait l'arme. Amen.

16. . . . . Nicole Lasie qui trespassa le mardi a 11 jors. . .

17. † Ci . . . . [Agn]es, jadis fille . . . . Cafran.

18. † Ci git le venerable chapelen messire Simon . . . . ois asis de Dia . . . . du chapitre de Nicosie.

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* See *L'Ile de Chypre sa situation présente et ses souvenirs du moyen-age*, pp. 340-396.

19. † Ci git le noble chevalier messire Hodra [de] Provane le tres noble . . . [qui trespassa l'an . . . . .] de Crist. Que Dieus ait l'arme. Amen.

20. [SUB IS]TA LAPIDE DORMIT . . .
CORNILLA DI BIANCHI
QUONDAM BERNARDI ME . . . . . ANTONI. VENERI. UXOR
. . . . . . UXO[RI] CARIS[SIMÆ] . . . . . .

21. MORATO STUDIOSOQUE JUVENI FRANCISCO D. R. DE MEGGIO NOBILI CRETENSI. LETALI VULNERE K. JANUARII INNOCENTER AFFECTO QUI XIII K. FEBRUARII CORPUS HIC, ANIMAM VERO CŒLO REDDIDIT, MATER MŒSTISSIMA POSUIT. A. MDXLIX.

ARMENIAN CHURCH.

22. † Ci git seur Sebille de . . . . ob . . . ser soupriоure de Notre Dame de Tourtose qui trespassa a M.CCC.XVIII a XXIII jors de Mars.

23. † Ici git dame Isabiau fille de dame Marguerite de . . . . . . feme qui fut de sire Johan Gras, qui trespassa l'an M.CCC.XVIII. a VII jors de Juin ; que Des ait l'arme.

24. † Ici git damoizelle Marie de Bessan fille qui fu de messire Gautier de Bessan laquelle trespassa en l'age de XVIII ans l'an de M.CCC.XXII de Crist, a vjors de Jun ; que Dieus ait l'arme. Amen.

25. A. † Ci git le noble chevalier messire Barthelemy de Tabarie qui trespassa le lundi a XIII jors d'Ahoust l'an de M.CCC.LXXXV, de Crist. Que Dieu ait leurs armes. Amen.

B. † Ci git madame Marie de Tabarie espouse dou noble chevalier messire Robert de Barut qui trespassa l'an de M.CCC.XXX. de Crist.

C. † Ci git madame . . . . . Conches espouze dou noble chevalier messire Berteleme de Tabarie qui trespassa l'an de M.CCC.XXXIV de Crist.

26. A. † Ici git messire Balian Lanbert qui trespassa a XVI jors de . . . . l'an M.CCC.XXXVII . . . .

B. [. . . . . . bien . . . . . Conches . . . . . . espouze qui trespassa a XI jors de Mars de l'an M.CCC.XXV Di[eu ait leurs ames.]

27. † Ici git dame Marguerite Escaface, fille de s. (sire) Origue Escaface, espouse de s. Simon Lengles qui trespassa a IX jors de Juing en l'an de M.CCC.XXXI de Crist ; Dieus ait l'arme. Amen.

28. † Ici git dame Margrite Menagier, espouse de messire Johan Nardes, qui trespassa le mardi a XXV jors d'Avril l'an de M.CCC.XL . . . de Crist ; que Dieu ait l'arme. Amen.

29. † Ici git s. (sire) André Ambroise qui trespassa a X jors de Setenbre l'an de M.CCC.XLV, de Crist ; que Dieu ait l'arme. Amen.

30. † A. Ici git dame [Is]abiau fille de dame . . . . de . . . . qui trespassa l'an MCCCX(L ?)VIII a VII jors de Juing ; que Des ait l'arme.

B. † Ici git dame Marie de Gras, espouse de messire Pierre Lengles qui trespassa a XVIII jors d'Avril l'an M.CCC.XLVIII, de Crist ; Dieu ait l'arme. Amen.

31. A. † Ici git seur Isabelle d'Agulier qui trespassa a II jors de Feuvrier l'an de M.CCCXL. de Crist.

B. † Ici git seur Sabine d'Angulier qui trespassa a VIII jors d'Avrill l'an de M.CCC.XLVIII. de Crist.

32. † Ici git suer [Eu]femie Escaface qui trespassa a XV jors d'Avril l'an M.CCC.XLVIII. de Crist ; Dieu ait l'arme. Amen.

33. † [Ci] git seur Anne de Montolif qui trespassa le mecredi a XVI jors d'Avrill l'an de M.CCC.XLVIII. de Crist ; Dieu ait l'arme. Amen.

35. A. † Ci git suer Annes de De qui trespassa a IX jors d'Avrill l'an de MCCCXLVIII de Crist. Dieus ait l'arme. Amen.

B. [† Ci git . . . . . .] espouze jadis messire Johan Gorap, laquelle trespassa le jeudi a XXI jors de Mars l'an M.CCC.LXIII. de Crist.

36. † Ici git messire Johan Ponsan, chevalier, raïs des Surines de Nicosie qui [trespassa le . . . .] l'an de MCCCLVI de Crist ; que Dieu ait l'arme. Amen.

37. A. † Ci git dame Isabiau de Neviles qui trepassa l'an de M.CCC.XCIII. de Crist.

B. Et git dame Marie de Milmars espouze dou noble chevalier messire de Neviles boutoulier dou roiaume de Chypre, qui trespassa l'an MCCCXCIII de Crist.

C. † Ci git dame Alis, fillie dou noble chevalier messire Johan Beduin, espouze de noble chevalier messire Johan de Thabaris, noble marechau dou reaume d'Ermenie qui trespassa le samedie a VIII jours de Setenbre l'an de M.CCC.LVII. de Crist. Que Dieu ait leurs armes. Amen.

38. † Ici git le noble chevalier messire Johan Thenouri qui trespassa le lundi a X . . . jors d'Avril l'an de M.CCC.LXIII. de Crist ; que D[ieu ait l'arme.] Amen.

39. † Ci git le noble chevalier monseigneur Johan de Tabarie, fis dou noble chevalier messire Bartelemi de Tabarie, noble maurechau dou roiaume d'Ermenie qui trespassa le mercredi a XXII jours d'Ahoust l'an de M.CCCC.II. de Crist ; Que Dieus ait l'arme. Amen.

40. † Ci git sire Nicole Paris cha . . . . XLII le Christ ; que Dieu ait l'arme. Amen.

41. . . . . git dame Agnes [de Carcasso]nne fille de messire . . . . . de Carcassonne [espouse] de messire Raimon . . . . . qui trespassa a . . . . Mai, l'an de . . . .

42. . . . . ave de Mirabiau . . . nature . . . tost la pris la mort, dont fu damage . . . . . etes. Amen.

43. Ci git la tres noble dame madame seur Es[ci]ve De Danpiere digne abaesse de la Croix d'Antioche et de Notre Dame des tr[ois Roi]s, qui trespassa. . .

CHURCH OF ARAB-ACHMET.

44. † Ici git Messire Hugue de Mimars qui trespassa dimenche à XV jors d'Avril l'an de M.CCC.XXIII. de Crist ; Des ait l'arme.

45. † Ici git messire Pierre Leiaune qui trespassa a IX jors d'Avril l'a[n] de M.CCC. e XLIII de Crist. Dieus ait l'arme de lui. Amen.

46. † Ici git le noble chevalier : messire : Lois : d'Nores. q' t'passa : l'verredi a XII jours : d'Hutouvr. l'an d' M.CCC.LXIX. d'x. q'Dieu ait l'arme de [lui].

47. † Hic jacet nobilis vir dominus Franciscus Co . . . . qui obiit anno Domini M.CCC.LXXXX . . . die XXV Genuarii, cujus anima requiescat in pace. Amen.

48. [Hic jacet nobilis vir] ac famosus magister . . . . . . dominus Antonius de Perguamo, regno Cipri camerarius, qui obiit anno M.CCC.XCIII. die XIX mensis Aprilis ; cujus [anima requiescat in pace. Amen].

49. Sepultura nobilis viri domini Gasparis Mauroceno, filii quondam domini B'leli de Veneciis, qui obiit die prima mensis Julii anno Domini M°.IIII°.II° ; cujus anima requiescat in pace.

50. . . . irele qui trespassa [de] ce ciecle l'an de l'[inca]rnation Jhesu Crist M.CC. . ., en VIII jors d'Avril.

CHURCH OF THE "ÉMERGHIE (? VIRGIN MARY)."

59. Ci git [le noble chevalier messire J]ohan Tenouri fils de . . . i . . . on (Simon ?) . . c . . . no . . . qui tres-

passa [le mar?]di a XI jors de Novembre, l'an M.CCCXLI de Crist.

60. Ici git messire Pierre de Nefin qui fu ch[ambellan]? qui trespassa a IIII jors d'Uitouvre, l'an M.CCC.LII de Crist; que Dieu ait l'arme. Amen.

61. A. . . . . Marie Antiaume, espose jadis de sire Rovo de Carpass, qui trespassa à VI jors de Juniet l'an de M.CCC.LXXXVIII. de Crist.

B. . . . . noble messire Johan Antiaume qui trespassa le mecr . . . de Novembre l'an de M . . . . Dieus ait l'arme o lui en paradis.

C. Ci git le noble chevalier Jaques de Montgesard ? . . . I un . . e . . . . arg . . . . fils de dame Marie Antiaume. Que Dieu ait leur arme.

62. [Ci git . . . . Je] han de [Ne]viles seignor d'Arsof qui trespassa le mercredi à XI jors de Janvier l'an de M.CCC.XC. de Crist; que Dieu ait l'arme. Amen.

63. A. Ci git le noble Chevalier Thomas [Provost] . . . . que Dieu ait l'arme. Amen.

B. Ci gist le tres noble escuer sire Ramon Provost qui trespassa a IX jours de Mai l'an de M.CCCC.XXXV. de Crist; que Dies ait l'arme. Amen.

64. Ci git le noble chevalier messire Heude de Vis qui trespassa l'an de M.CCC.CL.

65. [Ci] git messire Erbert de Noviers seignor de Montfort . . . [fis ?] qui [fu ? . . .] . . .nroan qui trespassa a XIII jours de Aust l'an de M.CCC[C? X ?]XV.

69. [Ici git] Eschive, filie dou noble chevalier messire Thomas de Cafr[an], espouse . . . . III de Crist; que Dieu ait l'arme. Amen.

70. [Hic] jacet nobilis Georgius doctor . . . . . tarsus ra . . . . condam d . . . . honorabilis medicus seri . . . . .

71. Ci git le noble et sage doctour des lois et decres messire Johan de Sarazins, de Padoua, honorable juge de . . . . XXVII; que Dieu ait l'arme.

72. [Ici git] . . . . dame Bienvenue de Cacaldier.

73. [Ci git] noble chevalier messire Phelipe de Milm[ars] . . . . Dieus ait l'arme. Amen.

74. Hic jacet religiosus frater Michael Monteguido, ordinis eremitarum Beati Augustini, qui obiit sub anno Domini M . . . . ensis Julii. Amen.

Church of Saint Catherine.

75. Ici git le tres honorable bourgeois . . . . Marguatz qui trespassa à XII jours d'Aoust l'an de M.CCC.-LXXIII de Crist; que Dieu ait l'arme. Amen.

FAMAGOUSTA.

Cathedral of St. Nicholas.

81. A. Ici git dame Dimenche fillie de sire Johan de Lion espouze de sire Guillaume Belaz qui trespassa le dernier de Novembre l'an de M.CCC.XLIX de Crist. Dieu ait l'arme. Amen.

B. Ici git dame Estefenie jadis espouse de Johan de Lion qui trespassa le mercredi a XXII jours de mars l'an de M.CCC.LXIII. de Crist; que Dieu ait l'arme. Amen.

82. A. Salvolus filius domini Habramini de [Quibellanicis] de Cremona, sub hoc marmore sepelitur, qui infra ætatis XVI annorum obiit, die II mensis Aprilis anno Domini M.CCC.LXIII. Cujus anima requiescat in pace.

B. Octavianus filius domini Abramini Quibellanicis de [Cremona] sub isto lapide requie[m habuit ?] anno [Domini] M.CCC.LXIII, die prima mensis Julii, cujus anima in pace requiescat.

83. Hic jacet nobilis . . . . . . venus Rubeus Pesarus . . . anno Domini M . . . . LX, die Junii.

84. A. Hic jacet . . . Molinus . . M.D.XXXIIII.

B. Hic jacet . . . filius Petri P[auli].

Church near the Palace.

86. Ici git damoizele Mer . . . . . ie qui fu jadis . . . . s. Gui des Petis, home de sene ? qui trespassa l'an de l'in[carnation] M. et CCC. e XLIII a VI jours d'Aoust; que Dieu ait l'arme. Amen.

87. Ici git damoizelle Loze fille s. Todre Seronea, qui trespassa le jeusdi, a II jours de Mars l'an de M.CCC.LXIII de Crist; que Dieu ait l'arme. Amen.

LIMASSOL.

88. Ici git Johan le Diaque, que Dieu [ait merci de son ame] l'an de M ⁝ CC ⁝ LX. . . .*

89. Ici gist sire Johan Corear chevalier qui trespassa de ce ciecle a XV jours du mois de Huitovre l'an de M ⁝ CCC ⁝ et XVIII ⁝ de Crist. Que Dieu ait merci de l'arme de lui.

KIVIDES.

94. Ici : gist : messire : Nicole Ca . . . . des Drapiers : qui : trespassa mardi : a le : XXI : jour : de Jugnet : l'an : de l'incarnation Ihesu Crist : M : CCCVI : Seignor : priez : por lui.

PAPHOS.

96. Brocardus : de Charpigny : miles : pater : Paphiensis : episcopi : cujus : anima : requiescat : in : pace. Amen.

97. Ici gist dame Alis [fil]lie de sire Says le Jenoeis que fu feme de sire Nicolose Saoneis, la-quelle arme vive en Crist. L'an de l'incarnation de nostre seignor Ihesu Crist M.CC.LXXIX. a XXII ? jors de Decembre. Pat[er nos]ter.

* M. de Mas Latrie says that this is the oldest inscription, after that of No. 1, he has seen in Cyprus.

II MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (i).

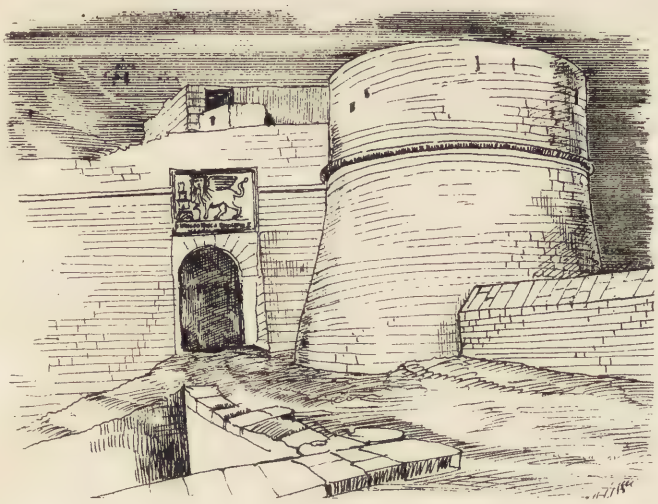


FIG. I, SKETCH FROM ABOVE THE WATERGATE, FAMAGOUSTA

FIG. 4, CHAPEL NEAR THE LAND GATE, FAMAGOUSTA

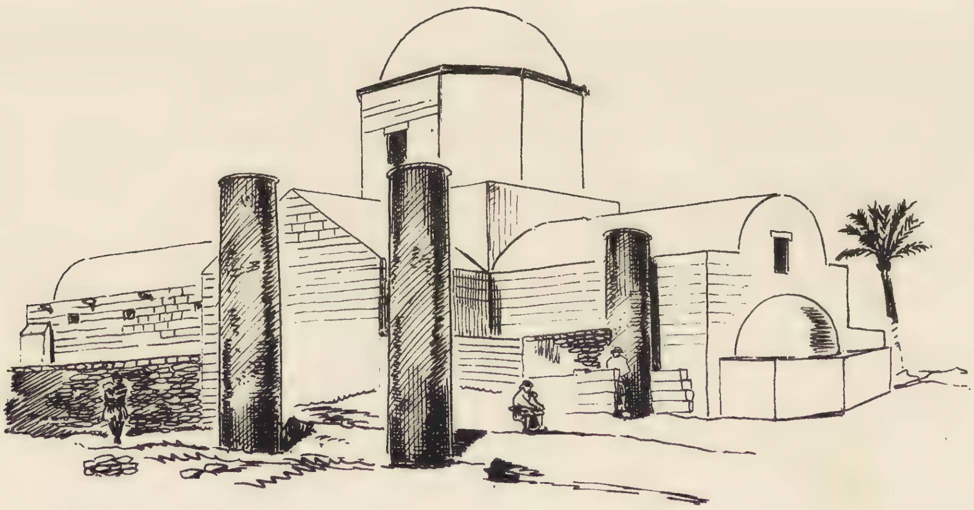


FIG. 2, REMAINS AT PAPHOS.

FIG. 5, GURGOYLE BUILT INTO WALL OF THIS MONASTERY.

FIG. 3, TOMB AT AI KATHARINA, NEAR SALAMIS.

FIG. 6, SKETCH OF MONASTERY.

Edward I'Anson del^t

C.F. Kell, Photo-Litho. Castle S^t Holborn, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (ii).

Sydney Vacher del^t. C.F. Kell, Photo-Litho. Castle S^t Holborn, London, E.C.

FIG. 7, WEST FRONT OF THE CATHEDRAL (NOW A MOSQUE), FAMAGOUSTA.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (iii).

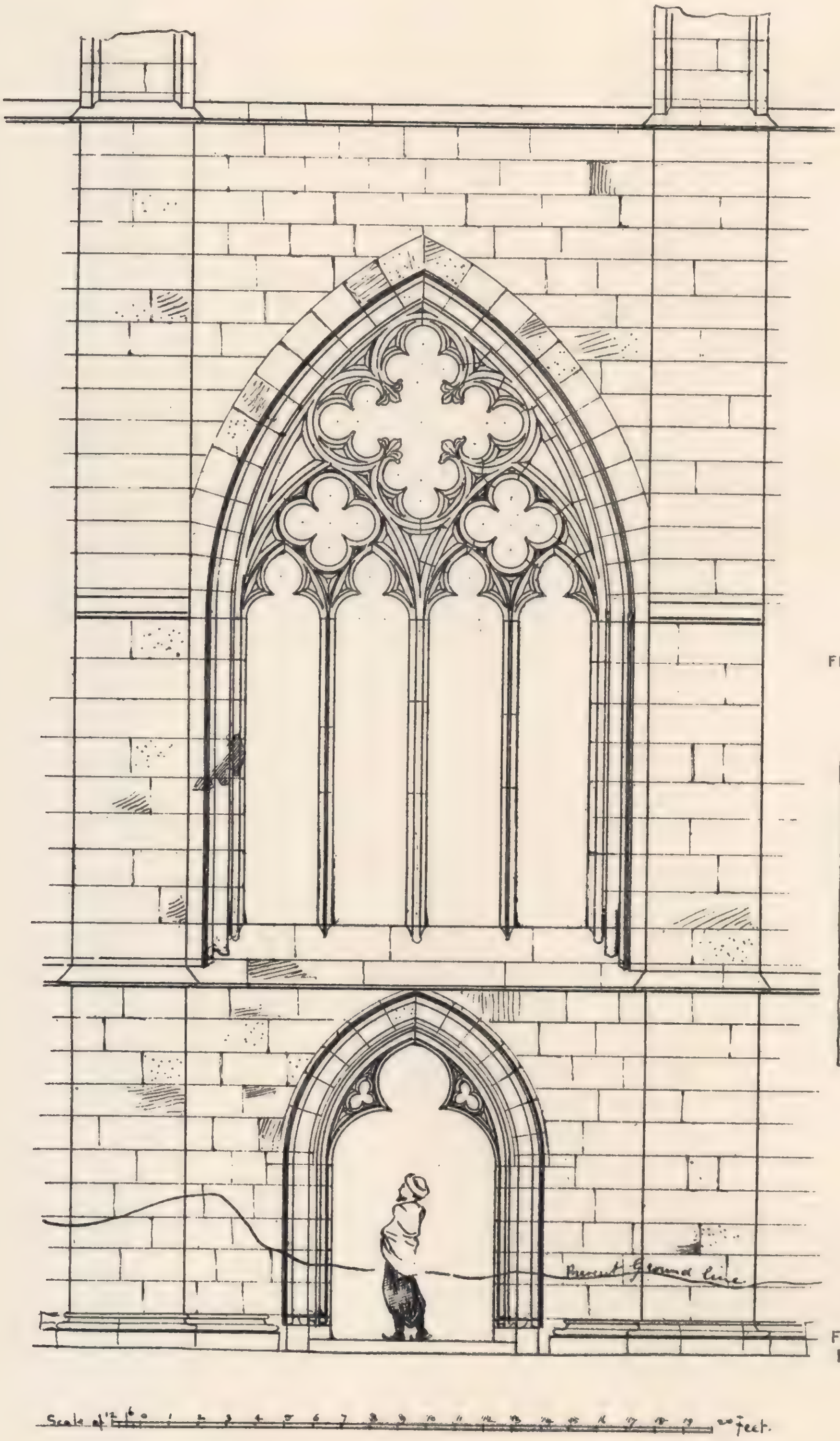


FIG. 8, NORTH DOOR.

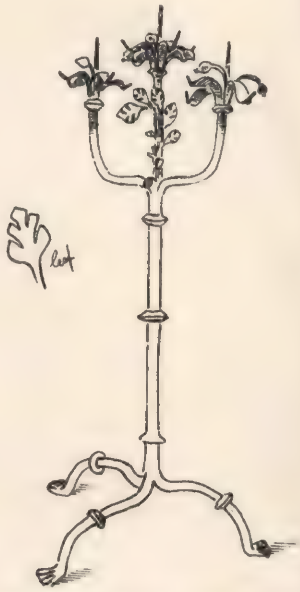


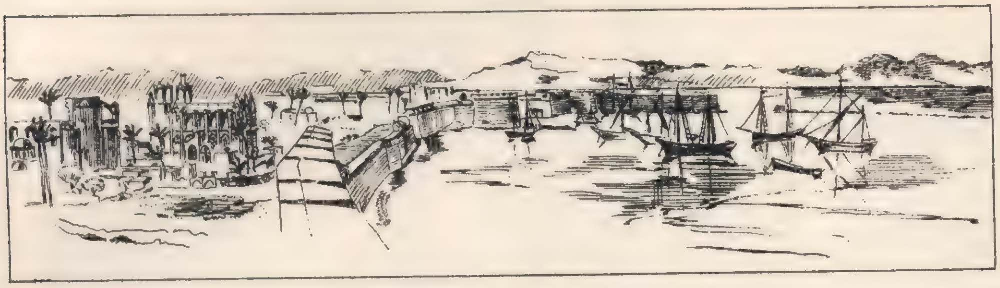
FIG. 9, ONE OF TWO IRON CANDLESTICKS NOW USED BY THE MOHAMMEDANS.

FIG. 10, INCISED BODY-STONES FORMING THE PAVEMENT OF THE CATHEDRAL.

Sydney Vacher delt.

THE CATHEDRAL (NOW A MO

FIG. 11, SKETCH TAKEN FROM THE RAMPARTS SHOWING CATHEDRAL AND TWO OTHER BUILDINGS.



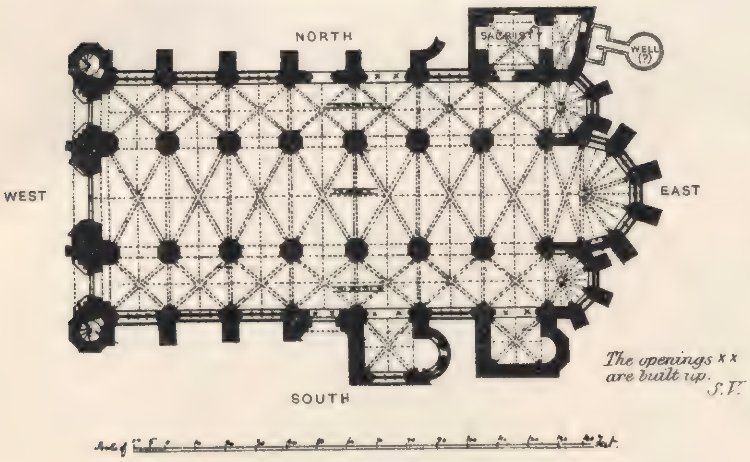


FIG. 12, GROUND PLAN OF THE CATHEDRAL.

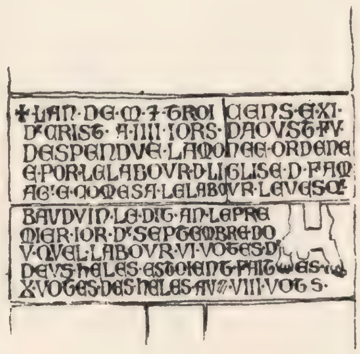


FIG. 13, INSCRIPTION AT E, SEE BELOW.

OSQUE),FAMAGOUSTA.

FIG. 14, SOUTH DOOR AS AT PRESENT.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (iv.)

Sydney Vacher, delt

FIG. 15, SKETCH FROM THE NORTH EAST.

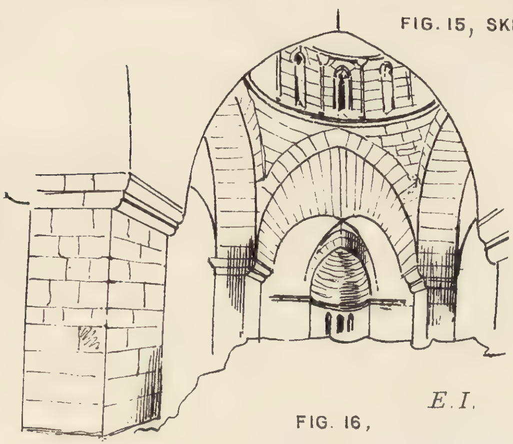


FIG. 16,
INTERIOR OF EARLY CHURCH LOOKING EAST

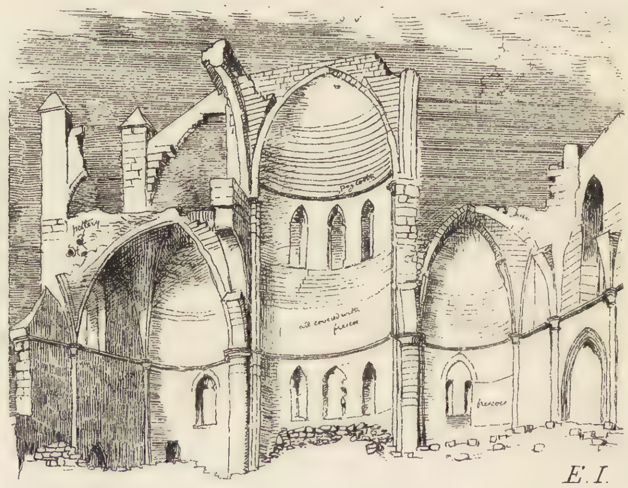


FIG. 17, INTERIOR OF LATER CHURCH LOOKING EAST.

CHURCH A. ABOUT 700 YARDS SOUTH OF THE CATHEDRAL, FAMAGOUSTA.

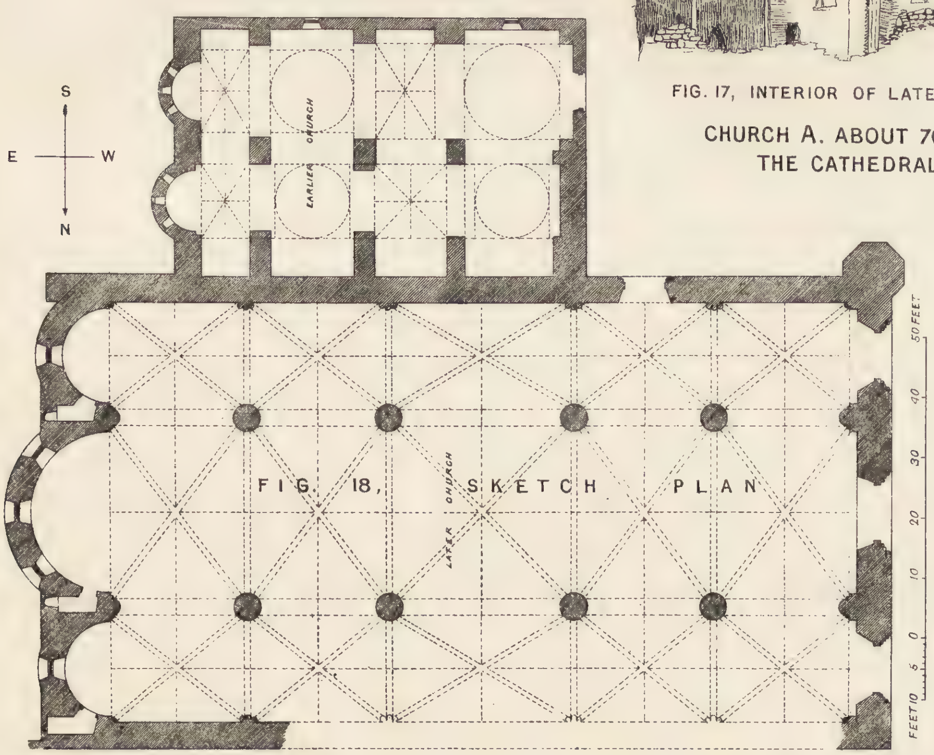


FIG. 18, SKETCH PLAN

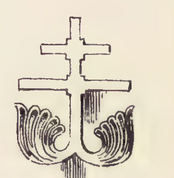


FIG. 19, CROSS ON THE RIGHT JAMB OF EACH OF THE THREE WEST DOORS.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (V).

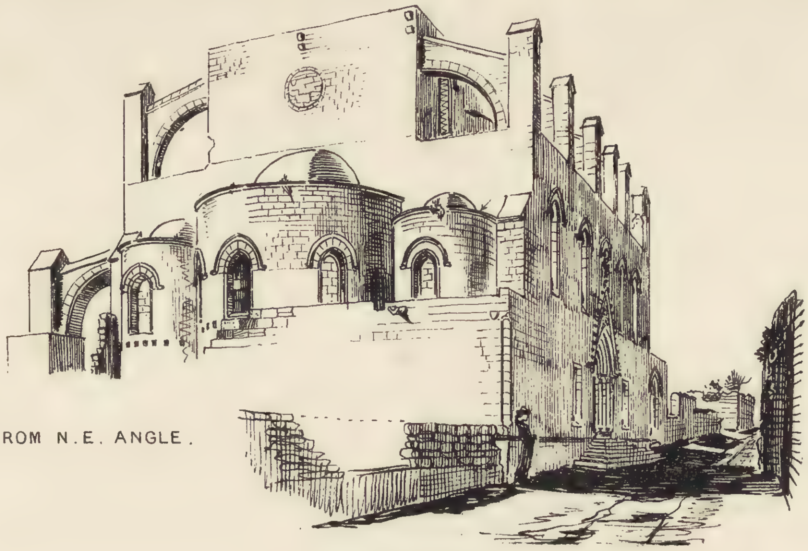


FIG. 20, SKETCH FROM N.E. ANGLE.

CHURCH B, AT FAMAGOUSTA.

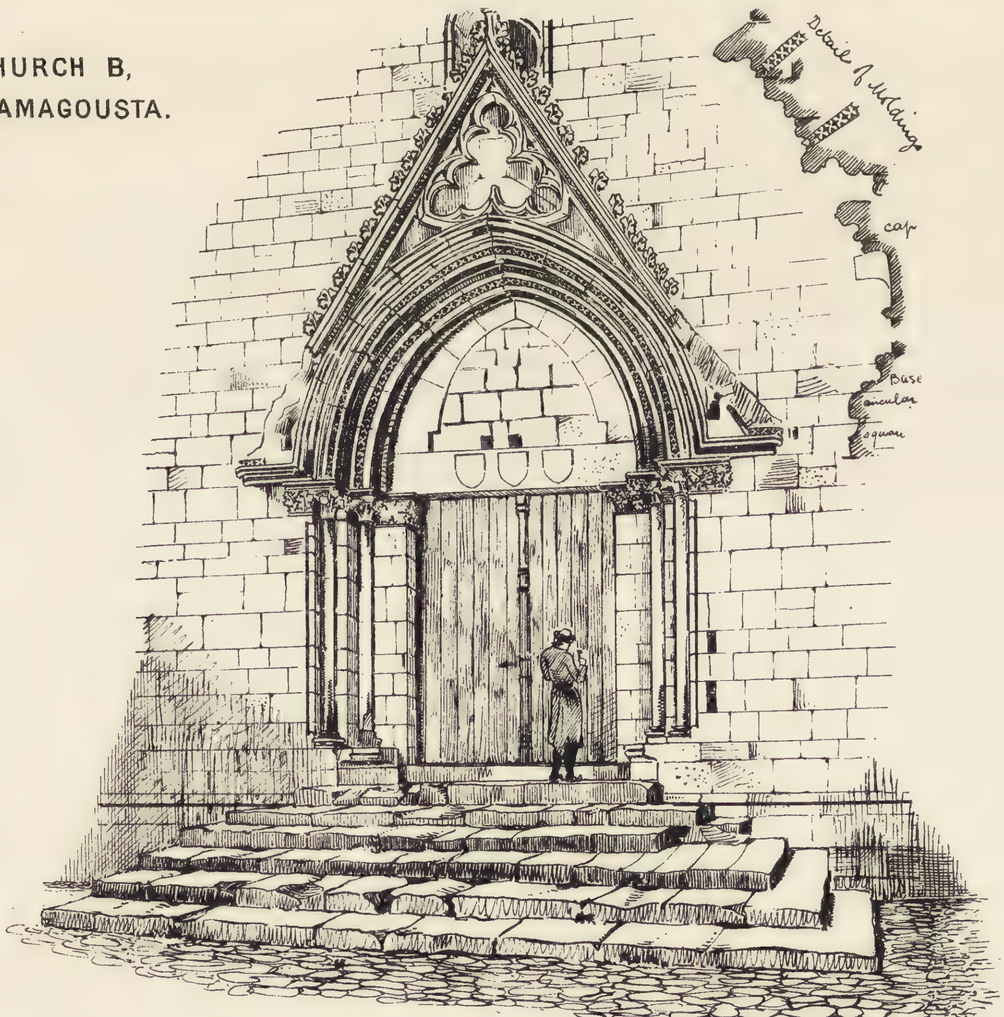


FIG. 21, SKETCH OF DOORWAY SHOWING THE OLD WOOD DOORS.

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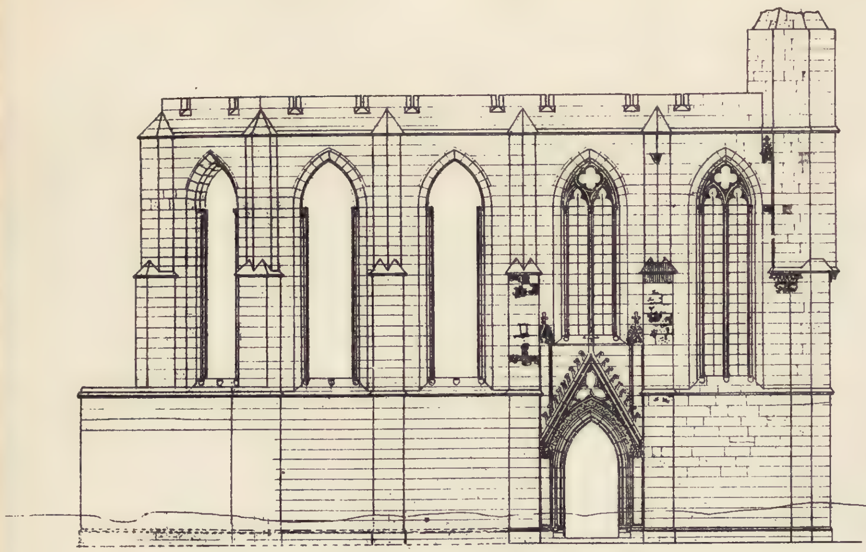
II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (VI)

CHURCH C. SOUTH OF THE CATHEDRAL AND CLOSE TO THE HARBOUR, FAMAGOUSTA.



N.B. THE WINDOW TRACERY IS Mr VACHER'S RESTORATION

FIG. 23, SKETCH ELEVATION.

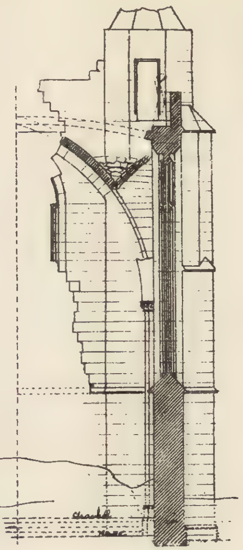
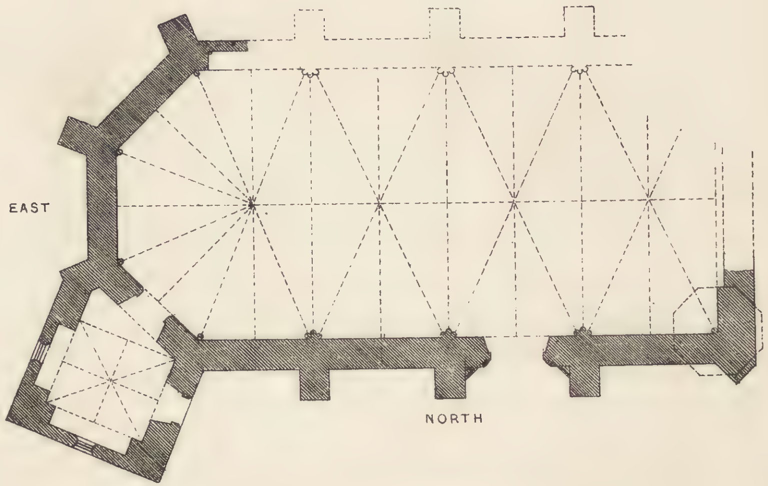


FIG. 24, SECTION.



Sydney Vacher delt

FIG. 22. SKETCH PLAN.

FIG. 25, NORTH DOOR.

N.B. MANY OF THE STONES HAVE BEEN CURIOUSLY AFFECTED BY THE ATMOSPHERE. S. V.

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II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (VII).

FIG. 27, SKETCH OF SOUTH BAY OF APSE.

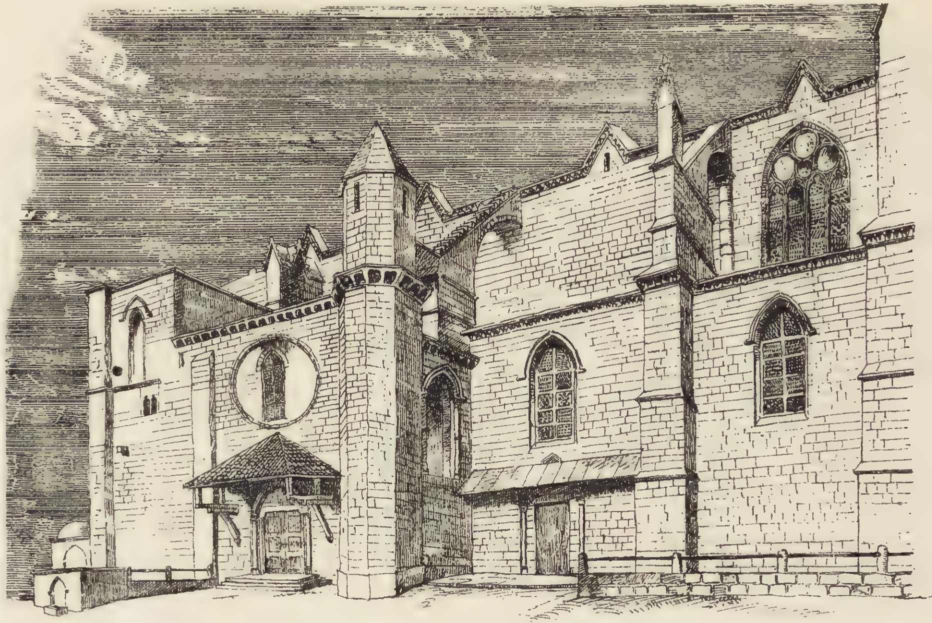
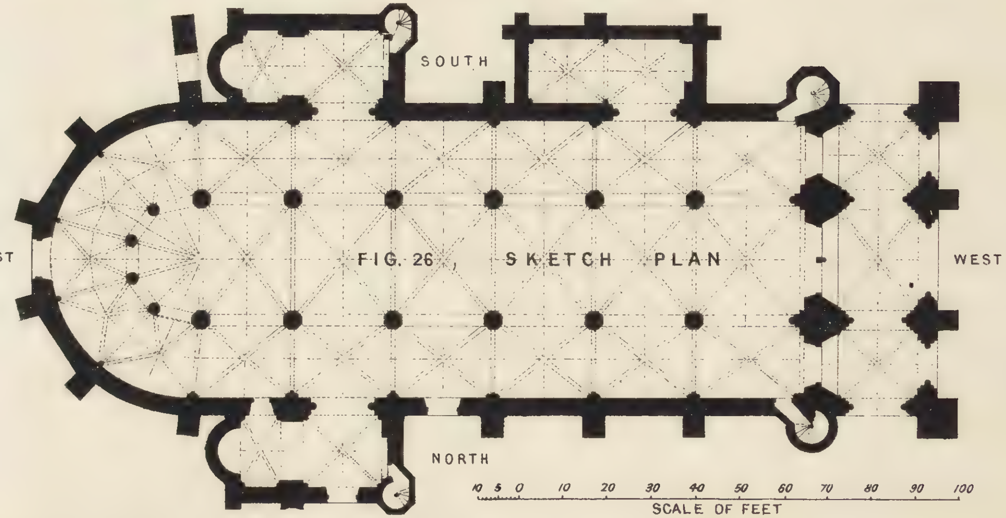


FIG. 28, SKETCH OF PART OF NORTH FRONT.



Edward I'Anson delr.

THE CATHEDRAL (NOW A MOSQUE), NIKOSIA.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (viii).

Sydney Vacher del.°

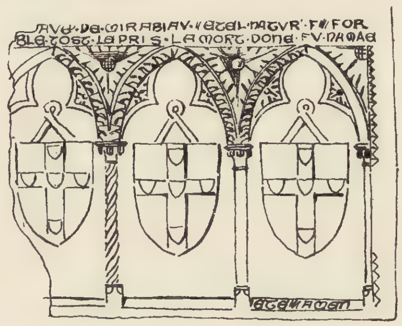
C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

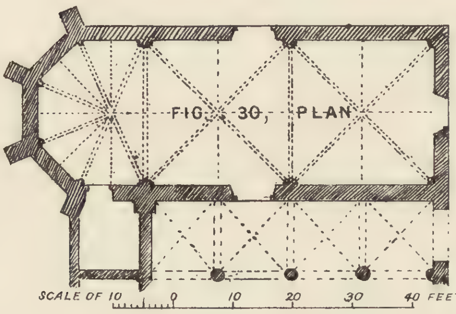
FIG. 29, WEST FRONT OF THE CATHEDRAL (NOW A MOSQUE). NIKOSIA.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (ix).

FIG. 31, SKETCH OF INTERIOR.

FIG. 32, REMNANT OF TOMB (UNDER ALTAR).





Sydney Vacher del.

ARMENIAN CHURCH, NIKOSIA. FIGS. 30. 31 & 32.

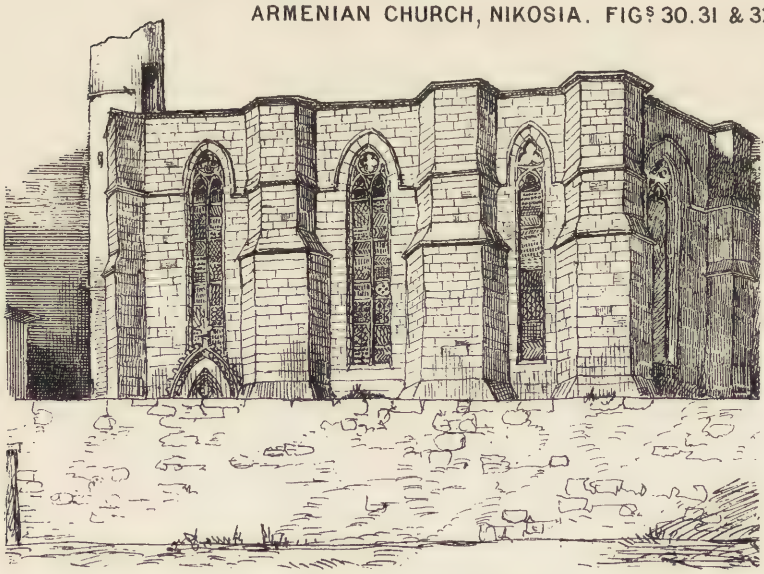


FIG. 34, SKETCH OF THE SOUTH FRONT.

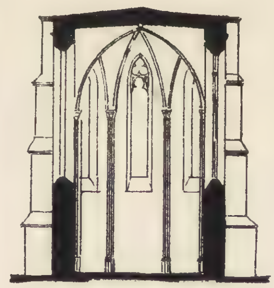


FIG. 35, SECTION.

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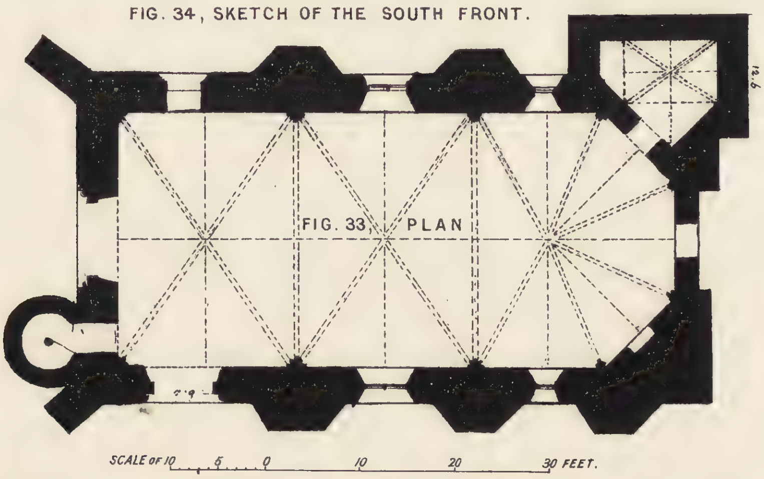

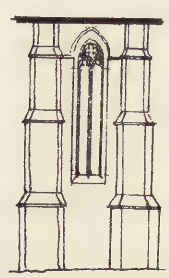

FIG. 36, ELEVATION OF ONE BAY.

ST. CATHERINE'S CHURCH (NOW A MOSQUE), NIKOSIA. FIGS. 33-36.

C.F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (x).

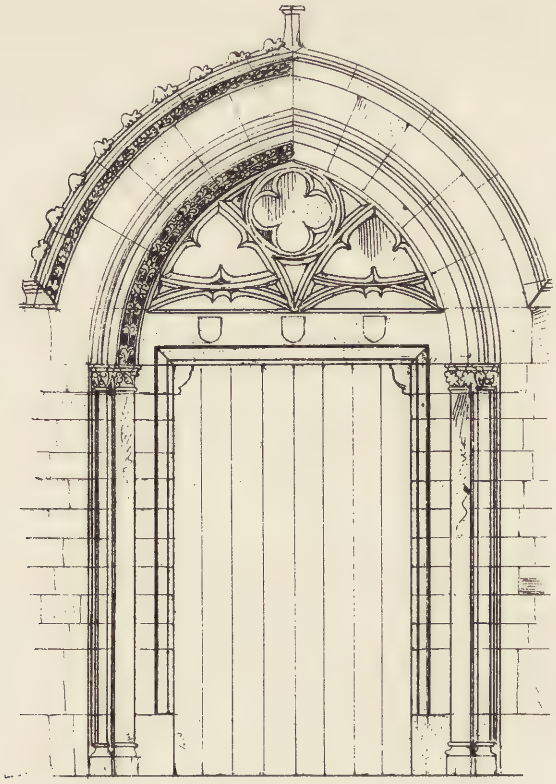

FIG. 37, SOUTH DOOR, ST CATHERINE'S CHURCH, NIKOSIA.

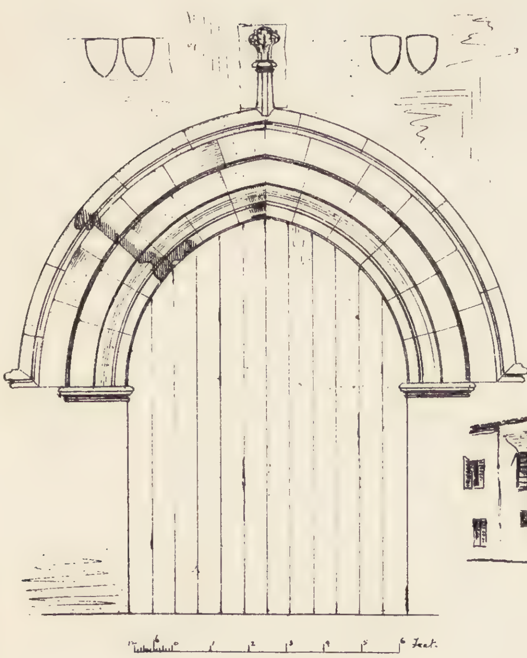

FIG. 38, DOOR AT A.B.

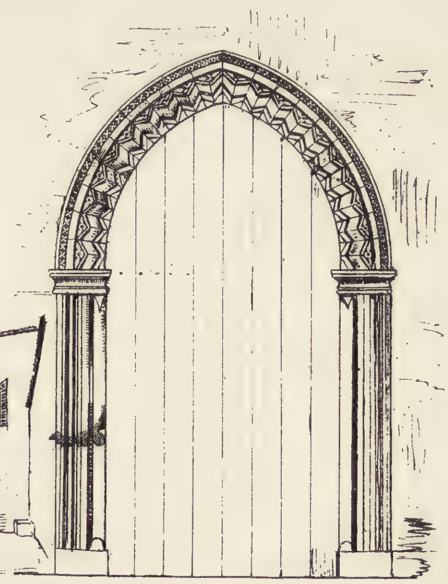

FIG. 39, STREET DOOR OF HOUSE AT NIKOSIA.

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C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (xi).

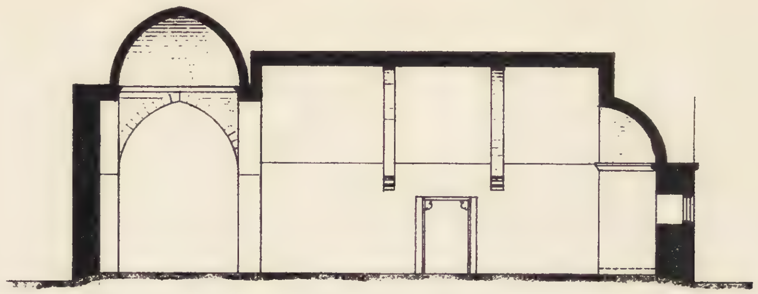

FIG. 41, LONGITUDINAL SECTION.

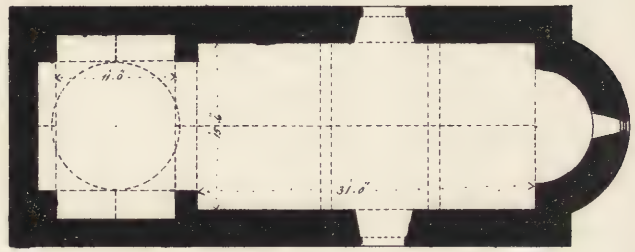

FIG. 40, SKETCH PLAN.

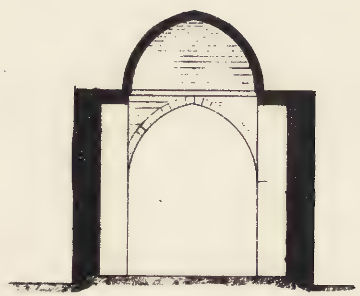

FIG. 42, SECTION LOOKING WEST.

FIG. 43, SECTION LOOKING EAST.

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CHAPEL D. ON THE HEIGHTS BETWEEN LARNAKA AND FAMAGOUSTA, FIGS 40 — 45.

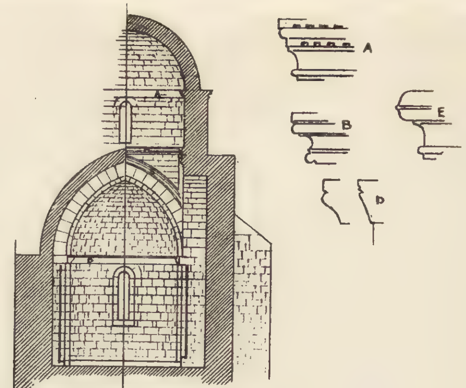

FIG. 47, SECTIONS A-A. × B-B.

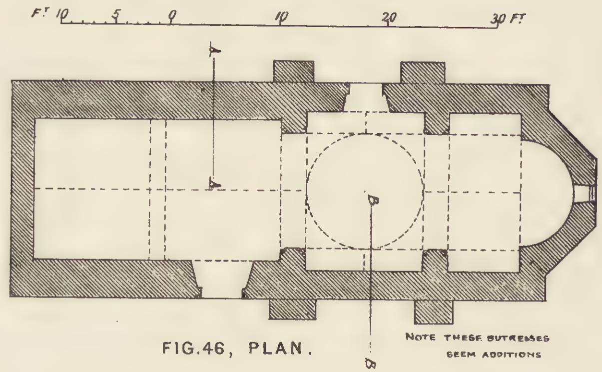

FIG. 46, PLAN.

RUINED CHAPEL E, FIGS 46, 47.

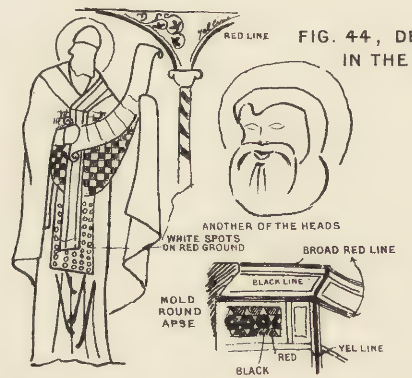

FIG. 44, DECORATION IN THE APSE.

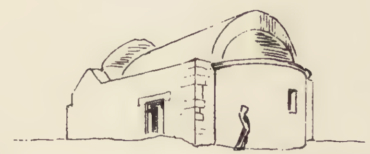

FIG. 45, SKETCH FROM SOUTH WEST.

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II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (xii).

FIG. 48. MARBLE TYMPANUM FOUND AT LARNAKA WHEN EXCAVATING FOR THE FOUNDATIONS OF A HOUSE.

C.F. Kell, Photo-Litho. Castle S^t Holborn, London, E.C.

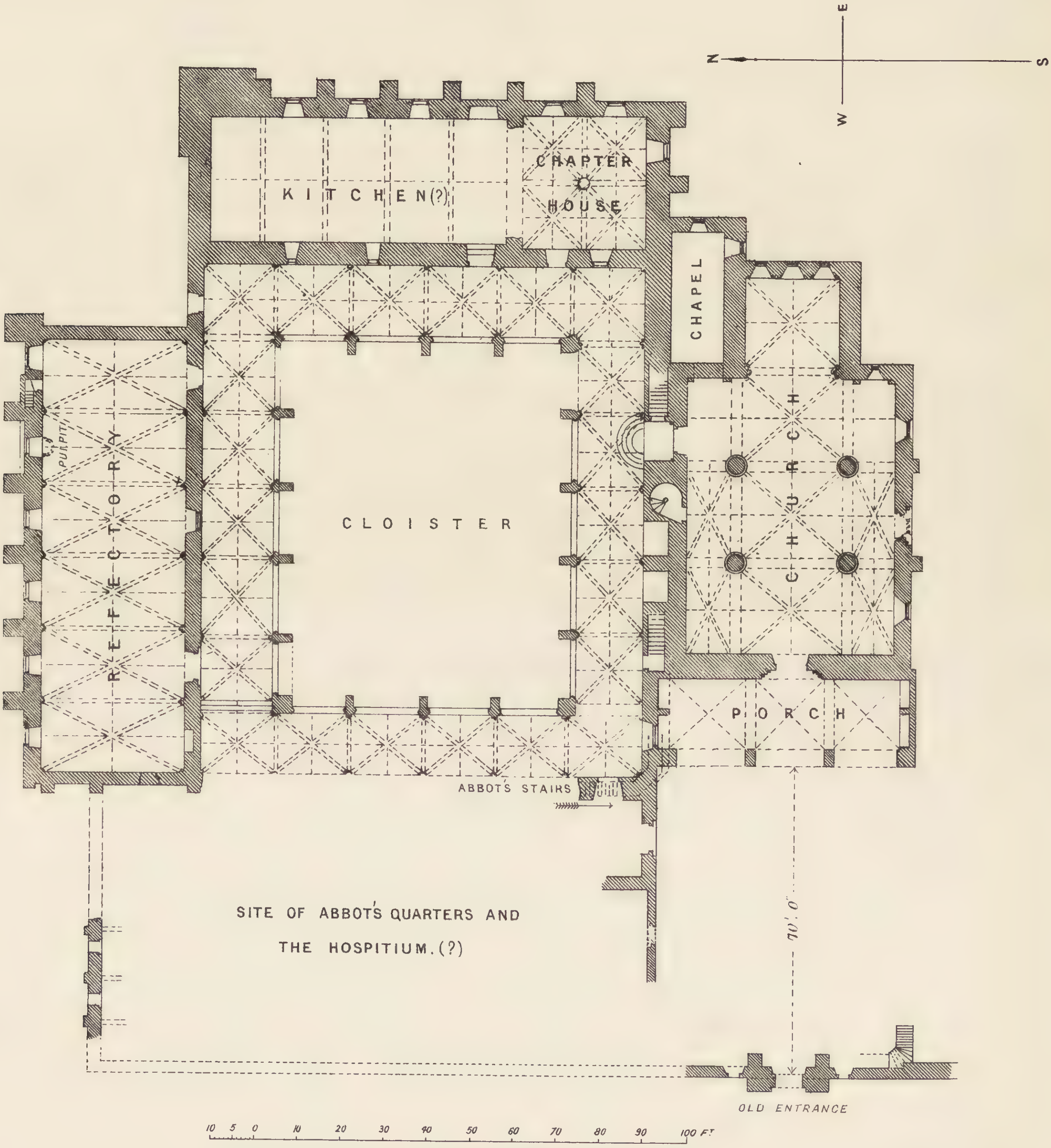


FIG. 49, GROUND PLAN OF THE RUINS.

MONASTERY AT BELLA PAIS.

Sydney Vacher, delt.

C.F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (xiv.)

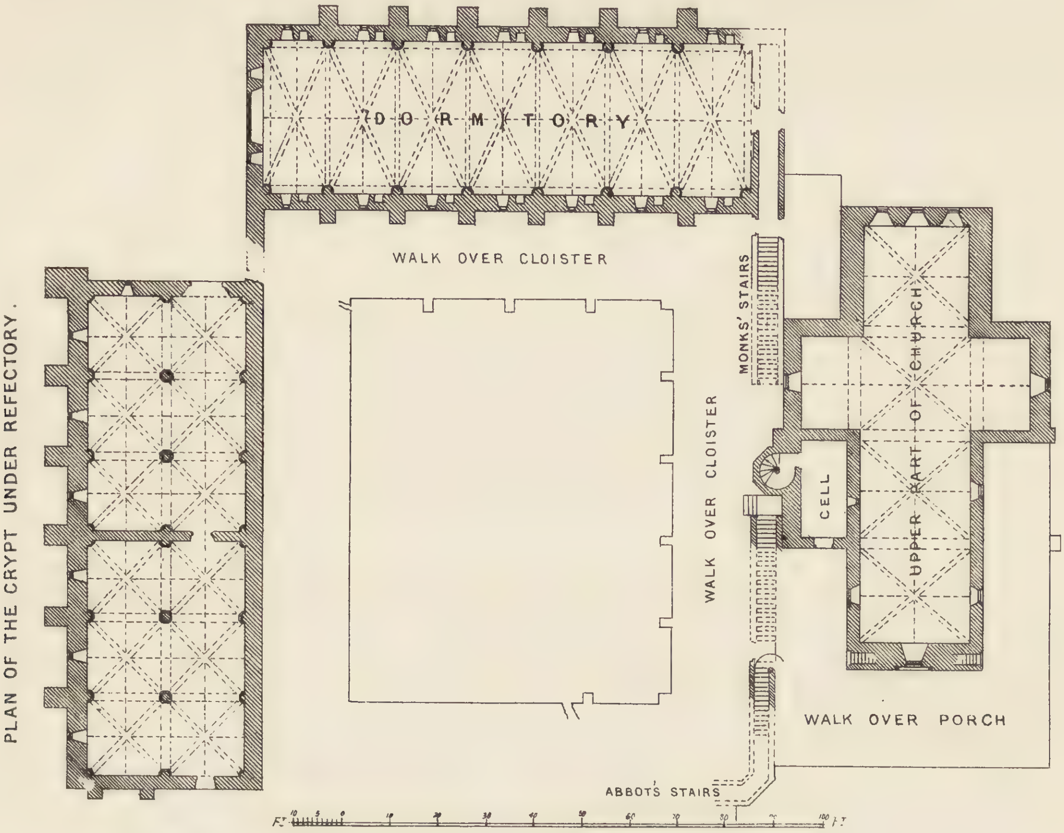


FIG. 49^A.

FIG. 50, PLAN OF THE UPPER PART OF THE RUINS.

FIG. 51, OLD ENTRANCE TO THE MONASTERY, (SEE FIG. 49)

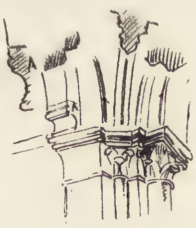


FIG. 52. CAP OF CHANCEL ARCH.

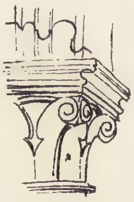


FIG. 53, CAP OF WINDOW BELOW BELFREY.

Sydney Vacher. delt.

MONASTERY AT BELLA PAIS.

C.F. Kell, Photo-Litho. Castle St Holborn, London. E.C.

Sydney Vacher, del.t

C. F. Kell, Photo-Litho. Castle St. Holborn, London E.C.

FIG. 54, INTERIOR OF THE CHURCH LOOKING EAST.

MONASTERY AT BELLA PAIS.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (xvi).

Sydney Vacher del.

C F. Kell Photo-Litho London. E C

FIG. 55, SKETCH OF ANGLE OF CLOISTER SHEWING DOOR TO REFECTORY.

MONASTERY AT BELLA PAIS.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (xvii).

Sydney Vacher, del.t

C.F. Kell, Photo-Litho. Castle S.t Holborn, London, E.C.

FIG. 56, INTERIOR OF THE REFECTORY.

MONASTERY AT BELLA PAIS.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (xviii).

Sydney Vacher, del.t

FIG. 57, SKETCH OF THE RUINS FROM THE OUTSIDE.

FIG. 58, SKETCH OF THE RUINS OF NORTH END OF DORMITORY.

MONASTERY AT BELLA PAIS.

C.F. Kell, Photo-Litho. Castle S.t Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (XIX).

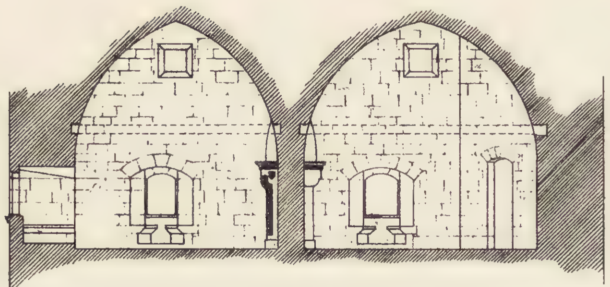


FIG. 60, SECTION THROUGH FIRST FLOOR

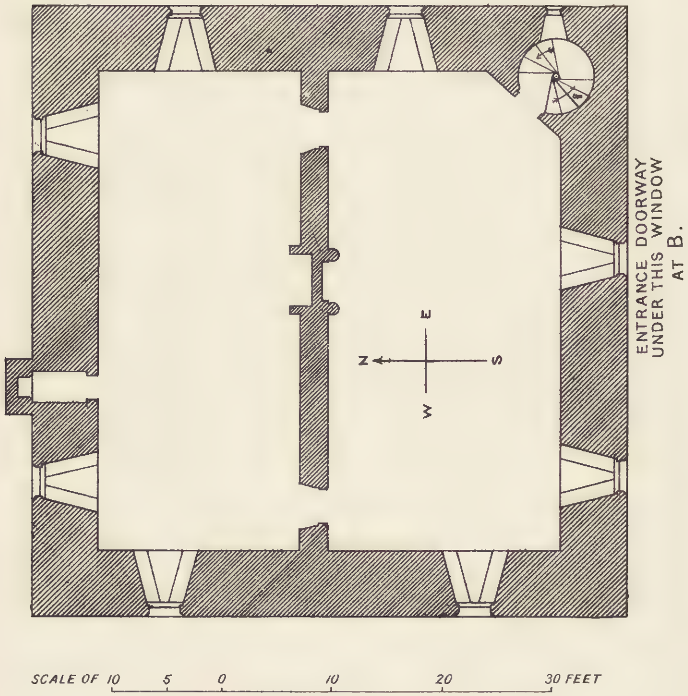
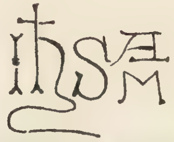


FIG. 59, PLAN OF FIRST FLOOR OF KEEP.



INSCRIPTION ON JAMB AT B.

DETAILS AT A.

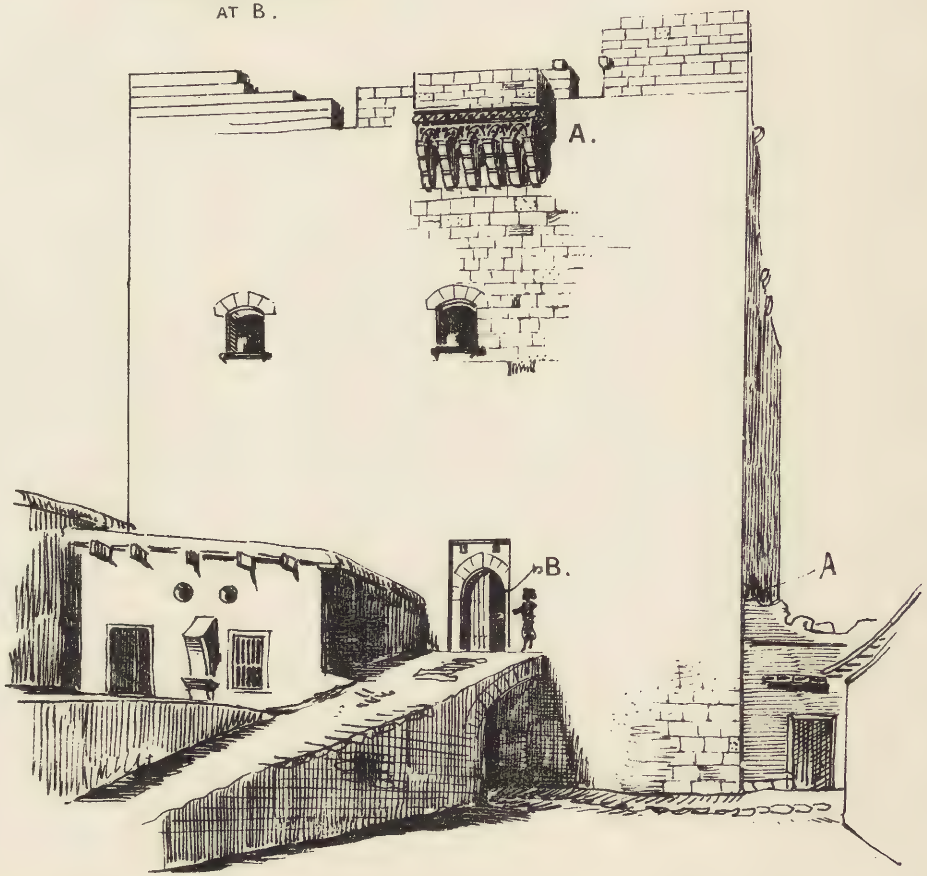


FIG. 61, SKETCH OF KEEP.

CASTLE AT KOLOSSI.

Sydney Vacher del.t

C.F. Kell, Photo-Litho. Castle S.t Holborn, London, E.C.

II. MEDIÆVAL AND OTHER BUILDINGS IN THE ISLAND OF CYPRUS (XX).

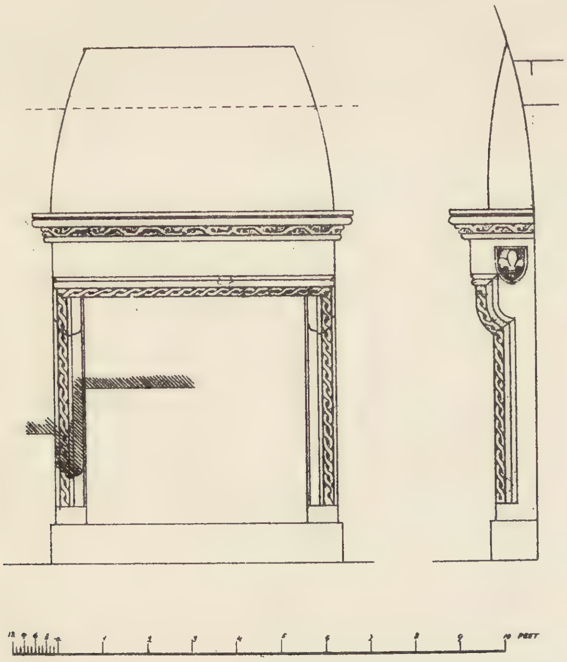


FIG. 63, DETAIL OF FIRE-PLACE.

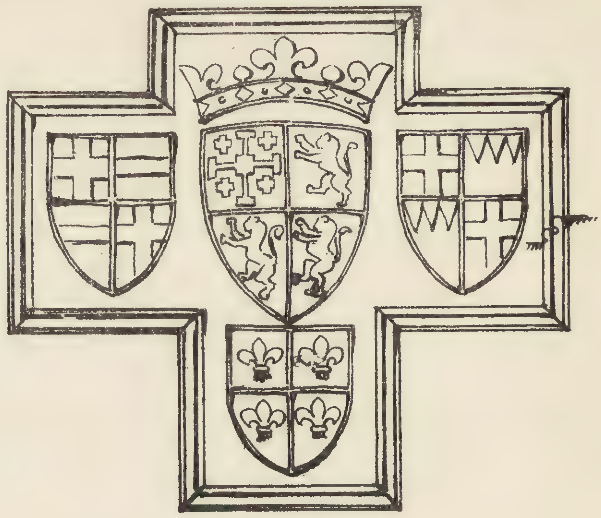


FIG. 64, COAT OF ARMS ON EAST WALL OF KEEP.

FIG. 62, INTERIOR OF FIRST FLOOR OF KEEP.

Sydney Vacher del.t

CASTLE AT KOLOSSI.

C.F.Kell, Photo-Litho. Castle St Holborn, London, E.C.

III. THE DECORATION OF THE DOME OF ST. PAUL'S CATHEDRAL.

By R. Popplewell Pullan, *Fellow*.

[Read on Monday, 4th December 1882, Horace Jones, *President*, in the Chair.]

A VEXED question, like that I am about to consider, cannot be treated in an open truthful manner except at the risk of wounding the susceptibilities of some, or of offending the prejudices of others, because no subject connected with modern art has aroused so much party feeling as this. For upwards of twelve years St. Paul's has been an arena for the warfare of parties and the battle of styles, and these petty quarrels have retarded the solution of the problem which gave rise to them. It is worse than puerile to make a party question of an undertaking upon the success of which depend such great issues as the reputation of our generation for good taste, not only among our contemporaries at home and abroad, but also among those who succeed us. Therefore I trust that in this instance we may put aside all sectarian feeling. For my own part I shall regret if anything I say should give offence to any of those eminent men who have been selected to undertake the direction of the work, and who, for the love of art and with great self abnegation, have voluntarily subjected themselves to the criticisms to which all in such prominent positions are liable.

The adornment of St. Paul's Cathedral is indeed the most absorbing art-topic of the day, and if, as I have just said, the verdict of posterity depends upon our success in accomplishing it, it behoves us to observe with a watchful eye every step that is taken, lest anything be done which is irremediably wrong.

At the present moment the control of the whole matter is in the hands of a Sub-Committee appointed by a body of distinguished men known as the Executive Committee for the completion of Saint Paul's. All that they do is subject to the approval of the Dean and Chapter, who have promised to submit this scheme for the decoration of the dome (the only part which it is at present proposed to complete) to the judgment of the public before anything final is undertaken. As such great interests are at stake it is evidently desirable that the public, who are to be the judges, should be apprized from time to time of the progress that has been made, and that they should be informed on small points by friendly discussions and enlightened criticisms, so that when they are called upon to decide they may be enabled to deliver a just judgment. Now the question at once arises—Who are those amongst the public who can claim to have a voice in the matter? What is duly qualified public opinion in art matters? What set of men are more likely to be competent to form a correct opinion about the decoration of a church? I can tell you, without hesitation, what in such matters duly qualified public opinion is not. Clearly it is not the opinion of those who object altogether to the use of figures in church decoration, forgetting that it was the practice of the early Christians to cover the walls and vaults of their places of worship with paintings in which figures played the most conspicuous part, as may be seen in the frescoes in the catacombs of Rome. Nor is it the opinion of those who dislike symbolism in art—of the men of science who object to representations of angels and lions with wings, because such an arrangement is not reconcileable with any system of anatomy with which they are acquainted. Still less is it the

opinion of the mere men of fashion who acknowledge that the dome of St. Paul's is "pretty well "scooped out," but can "see nothing in it." Nor is it the opinion of those who cannot trust their own judgment, but blindly follow any art critic, provided he shout loud enough, however incompetent he may be. No: duly qualified public opinion in artistic matters is that of a body of men of educated taste, and I may perhaps be pardoned a slight digression for the purpose of defining what I mean by educated taste, for it is often necessary to be elementary in order to be thoroughly understood. Taste may be defined as the faculty of being able to discern beauty in nature and art. As there are two degrees of beauty—that which appeals to the senses, such as perfection of form and colour, and that of fitness which appeals to the intellect; so there are two degrees of taste—that which is natural to, and inherent in, certain individuals, a higher susceptibility which enables them to appreciate the æsthetic qualities of beauty, and that which is acquired, a knowledge which enables them to detect anachronisms and anomalies in an imitative work of art. The combination of these two powers, as I may call them, forms the man of educated taste. To give an illustration of what I mean: if the cupola of St. Paul's were covered with patterns copied from the Alhambra, the man of mere intellectual taste would express admiration of the beauty of the forms and the harmony of the colouring, without perceiving the unsuitability of the style. The educated man of taste, being more far-seeing, would reject the whole as incongruous and out of character with the edifice.

Thus in matters connected with the art and science of architecture the most competent judges are evidently those who have acquired a knowledge of the varieties of style and modes of construction, in addition to being gifted with an eye for form and colour. Where then, may I ask, are to be found men who have been accustomed to decide about such things, who by practice, by study, by travel and observation, are most likely to have become men of cultivated taste, if not here, amongst the members of the Royal Institute of British Architects? Who better qualified than they to decide about the merits of any scheme that may be proposed for the decoration of the greatest work of the greatest British architect?

Sir Christopher Wren appears to have changed his opinion in later times about the proper mode of decorating the dome, if we are to believe the compiler of the *Parentalia*, who asserts that it was Sir Christopher's intention, "instead of painting in the manner it is now performed, to "have beautified the inside of the cupola with the more durable ornament of mosaic-work, as is "nobly executed in the cupola of St. Peter's in Rome." Notwithstanding this protest, it is very probable that, had Sir Christopher had the direction of the decoration in the first instance, the treatment would not have been very dissimilar in style from that adopted by Sir James Thornhill, for be it remembered that Sir James decorated Greenwich Hospital and other buildings under Sir Christopher's supervision, and must have been thoroughly conversant with his ideas on the subject. Some go so far as to assert that Wren approved of Thornhill's design, but I have not been able to find proof of this assertion, yet I think it very probable; and this is a point which I beg you to keep in mind, for if it be the case, that Thornhill's pictures met with the approval of the great architect, any future scheme ought to be based on Thornhill's, if we wish, as we profess to do, to carry out to the best of our abilities Sir Christopher Wren's intentions for the decoration of the dome. The only difference he would have made would have been to substitute polychrome for monochrome.

Nothing was proposed to be done towards carrying out Wren's desires until the year 1773, when Sir Joshua Reynolds suggested that it might be realized by the members of the Royal Academy. Acting on his suggestion six artists, West, Barry, Dance, Cipriani, Angelica Kauffman, and Reynolds himself, offered to devote their talents to the task gratuitously. Fortunately the scheme fell to the ground, or we should have had a medley of style and colouring which would have gone far to destroy the effect of the architecture. Imagine the effect of Sir Joshua's gentlemanly saints, and West's indefinite scriptural subjects, by the side of Barry's bold martyrs, Angelica Kauffman's delicate virgins, and probably later on Fuseli's grim demons!

In 1853 Mr. Parris was employed to restore Thornhill's pictures, and that this was useless labour may be ascertained by any one who will take the trouble to look upwards through the cloud of mist which generally hangs in the dome. He will with difficulty perceive the outlines of Thornhill's groups, still less will he be able to see in what condition his paintings are. In excuse for Thornhill, however, we must recollect that the atmosphere of London is now fifty times more dense and misty with smoke than it was in the day when the paintings were executed, and that then probably they were visible in all their details. In 1858 Dean Milman, writing to the Bishop of London, suggested that the adornment of St. Paul's should be carried out in a rich and harmonious style, "in unison with our simpler form of worship." An appeal was at once made to the wealthy citizens of London who took an interest in their cathedral, and the sum of £24,000 was raised in a short time. By the year 1871 the subscription had reached the amount of £40,000. The Thanksgiving Day for the recovery of the Prince of Wales gave an impetus to the movement, and the fund rapidly mounted up to the sum of £56,000. Meanwhile the gentlemen who had this large sum at disposal had been looking about for the purpose of obtaining a suitable design. Their first and most natural conclusion was no doubt to intrust the work to the Surveyor of the fabric, Mr. Penrose, who was to have the co-operation of those most qualified to advize. Thus Mr. Burges, who had studied iconography more thoroughly perhaps than any one, was invited to give a general scheme for the decoration of the whole cathedral; and so far these two architects worked cordially together. Mr. Burges says in his report on the iconography, "I have had sundry consultations "with your architect, Mr. Penrose, who has most kindly offered me every facility." Had the Committee been content with such an arrangement the work might have been half finished by this time; with Mr. Burges's general scheme, Mr. Penrose to design the architectural ornament in accordance with Wren's architecture (and who could be supposed to have a better knowledge of Wren's architecture which he had ever before him?), and duly qualified painters to design the mosaics, the whole would have gone on smoothly and satisfactorily. But such a system of proceeding did not suit the majority of the Committee, and Mr. Burges had the title of architect to the cathedral, I might almost say, thrust upon him in 1873. He was then instructed to prepare designs, which were to be subjected to Mr. Penrose's criticism. Mr. Burges's design, which in the form of a model was exhibited in the Royal Academy in 1874, called forth a storm of criticism. High Churchmen, low Churchmen and no Churchmen filled the columns of the daily papers and the reviews with their opinions for and against his scheme. Vocabularies were searched for terms of ridicule, and as a last resource the epithet "mediævalist" was resuscitated, and the battle of the styles renewed. Then

in 1874 the minority of the Committee protested against the decision of the majority:—1. Because no hint about the decoration of the dome was submitted by Mr. Burges, nor was the local improvement of the choir touched upon by him in his report. 2. Because breadth of treatment and massiveness were lost in complexity of polychrome; because the design was at variance with Sir Christopher Wren's notions, and with the practice of the Italian architects of the sixteenth century.* 3. On account of the quantity of colour and crudeness of decorative materials, also because the names of the artists chosen by him to carry out the work were unknown to fame. For these reasons it was considered that the expenditure of so large a sum as that of the estimate (£400,000) would tend to the debasement of art, the corruption of pure taste, and the discredit of the country. All these influences told against Mr. Burges, and in November of the same year the Dean and Chapter, "finding that the divided state of opinion in the Executive "Committee, and also in their own body, hindered progress," decided to rescind the agreement made with Mr. Penrose and Mr. Burges. Nevertheless, in the designs of both were many good points, and had it not been for the exhibition of party spirit the work might have gone on.

After the rejection of these designs the wordy warfare ceased for the moment, and there was a time of truce until 1876, when Mr. Oldfield, an eminent antiquary, one of a Sub-Committee of five who had then been authorized to take steps for the completion of the decoration, revived the whole subject in a very able letter to the Dean, published in the form of a pamphlet. In this letter the author states that he had made a tour in Italy "to note any "characteristics in the decoration of the churches most resembling St. Paul's in style which might "furnish instruction for any future plans, showing us, either by their excellence or their defects, "what to do, or what to avoid." Of all the churches he visited he thinks St. Peter's at Rome that from which the greatest number of practical hints may be derived. He deduces a number of rules from the observations of those buildings, and finally makes a suggestion which the Sub-Committee, worried by architects and their friends, seem to have jumped at as the ground of future proceedings. This idea† is contained in the following passage:—"Lastly it would be "no small advantage in commencing our work, that we should not need an architect to furnish "us with a design; for thus we should not merely avoid considerable expense, but escape the "almost insoluble difficulty of finding any member of the profession who would at the present

* This refers chiefly to the liberal use of coloured marbles which Mr. Burges proposed.—R. P. P.

† Mr. Oldfield developed his idea (see pp. 86, 87 and 88 of his Letter to the Dean, entitled *Saint Peter's and Saint Paul's*, &c., Lond. 1876) as follows:—

"If the views here submitted are approved in principle, the best method of acting on them is a question of detail, and will hereafter be determined by you, Mr. Dean, and the Chapter, aided by the Committee of Advice intrusted with the completion of Wren's great work. Nevertheless, to give greater distinctness to my proposal, and assist the reader in judging how far it is really practical, I will roughly sketch out the course of action I would suggest. We have at least three eminent artists, Mr. Watts, Mr. Leighton and Mr. Poynter, who have each some experience in adorning the walls of churches or other public buildings with sacred, historical, or ideal figures, executed either in mosaic, or with some pictorial medium. It might perhaps be thought best to intrust the designs for our mosaics either to one of these gentlemen, or some other artist with similar qualifications. But it would be quite in accordance with the traditions of old Italian Art, no less than with modern English practice, to select three or four of our painters, implying honour in the very selection, and to invite them to submit competitive designs. The Surveyor of the Cathedral might be requested to arrange the competition in professional form, on terms of liberality befitting the estimation due to those who are called to represent the highest Art of the country in a great national work. He should likewise be instructed to supply each artist with architectural drawings and measurements of the cupola, with all needful

"time be acceptable to all sections of the subscribers." So then the architectural decoration of the greatest work of the greatest national architect ought, according to him, to be executed without the assistance of an architect. Why, forsooth? Because the subscribers were not likely to agree as to the election of any one man; because, if all classes of subscribers had been consulted in the matter, there would have been as many architects as classes of subscribers!

The Sub-Committee, having dispensed with architects' designs, sought for a design from other sources, and finally accepted a model on which a sculptor, the late Mr. Stevens, had left some rough indications of his notion about the decoration of the dome; and I may here repeat that the Sub-Committee had determined to spend their money on the dome in preference to commencing in any other part of the edifice. The discovery of that model was most opportune for the Sub-Committee, for it became a tower of defence against the attacks of their critics; and they further fortified their position by entering into an alliance with two of the chief painters of our day—they made a formal agreement with two eminent men, stipulating that Mr. Stevens's design should be taken as a basis. They stipulated that a full-sized coloured cartoon should be placed *in sitû*, a portion of which was to follow his design literally or with some modification, the other portion being of a more conventional or architectural form, but in any case Mr. Stevens's arrangement was to be worked-out and become a frame to be filled with pictures, the subjects of which were to be taken from those suggested by Mr. Oldfield in a second letter to the Dean, viz.: Scenes from the Apocalypse. They made an agreement also for the execution of the more mechanical portion of the design with Mr. Hugh Stannus, who was a favourite pupil of the late Mr. Stevens, and who is now an Associate of the Institute of Architects. The Dean and Chapter assented to the experiment, reserving to themselves full power of discussing the matter, and also the power of rejecting the cartoons if they should be unsatisfactory. But with all due deference to the Dean and Chapter and to Mr. Oldfield it seems to me that a more mystical subject, or one less qualified to instruct the people, or to inspire devotion, could not have been selected than the Apocalypse, the study of which, it has been said, either finds or leaves a man mad. Unless it were intended to divert people's minds at sermon time—to occupy their thoughts with paradoxy instead of orthodoxy—I am at a loss to conceive why the Apocalypse was chosen.

When, in the summer of 1878, the Report of the Sub-Committee reached me, announcing their decision on this matter, and that they were determined, as it appeared to me, to dispense with the services of an architect, I confess, being also struck by the unsuitableness of what may be called a "patchy arrangement," to feeling a little jealous for the honour of our art. Full of burning thoughts I suggested to my late lamented friend Mr. Heath Wilson, of Florence, that he and I should prepare a design on strictly architectural lines, in accordance with the style of St. Paul's and other similar buildings; and that for our theme we should choose one which, on account of its simplicity, would be understood by all, and by its devotional character would tend to raise the devout feelings of the worshippers, assembled for prayer and praise beneath the dome: that magnificent Hymn of Praise common to all

information as to its structure and condition, and such other technical advice and assistance as his well-known learning and scientific accomplishments would enable him easily to give, and as might be requisite for the successful exercise of their artistic powers. The general limitation, by which all the competitors would be bound, would be that their designs must be fitted for mosaic, and strictly in the style of the cupola of St. Peter's."

churches, the Te Deum—so that all those congregated beneath the dome would see represented to their uplifted eyes the whole Court of Heaven described in that anthem, in communion with whom they were worshipping.

In the first place we paid due regard to Sir James Thornhill's arrangement of ribs, arches and coffres, believing that his designs must have been seen, and to a certain extent approved, by Sir C. Wren, otherwise he would have uttered a strong protest against them, whereas he merely complains that the painting was taken out of his hands; and we endeavoured to carry out in like manner the idea of construction.

The chief fault that has been found with Thornhill's decoration is that soffits of arches are seen in perspective, and that the architectural members are shaded. In this age of supreme good taste in the arts it has been discovered that the representation of ornament and mouldings with shading is not truthful, but a sham; everything must be flat, or it is a mockery and a deception. Now I contest this idea from its very root. All art is deceptive, and the painter who could paint a figure so well that it would appear to walk out of its frame would be considered the greatest painter of his day. While it would be inconsistent with good taste to represent raised patterns on a carpet, where they could not possibly exist, I see no objection to their being represented on walls and ceilings where they could exist. This system of what may be called scenic decoration has been adopted by all decorators from the earliest times up to the present day. We see it on the walls of the houses of Pompeii, where temples and other edifices are represented in perspective, with as much shading as would be consistent with proper effect. We see it in the works of Roman times and even in byzantine and mediæval times, when the knowledge of perspective and of sciography was not so extensive. But chiefly we see it in the works of the great Italian artists and decorators of the 16th and 17th centuries, which are recommended by the Sub-Committee as worthy of imitation. Giotto, Ghirlandajo, Mantegna, Perugino and Raffaelle have left examples of it; and if the opposite principle be true, if it be incorrect to represent mouldings and other architectural members with shading, that grand composition, the ceiling of the Sixtine Chapel, is nothing but an enormous sham. Many of you may remember, in the apartments of the Louvre, certain imitative paintings of *relievi* in bronze and marble which are so well executed that, unless you have looked at them from various points of view, you are unable to ascertain whether they are real or imitative. These I regard as fine specimens of decorative art. This scenic painting has been the practice of all the great artists, as I have said, up to the present time, and with this goodly company we—Mr. Heath Wilson and myself—were content to stand or fall. We therefore introduced a certain amount of shading with the architectural composition—simply in the niches where there are seated figures, and in the colonnade above. Here, I may remark, it would be absurd to shade figures as though they were standing out, that is to say, to give them roundness and relief, and yet to object to treat the backgrounds, in front of which they stand, in the same manner. Still you will observe that there is as little perspective or shading as possible, and that the general effect is that of a flat picture.

Having thus accepted the principle of what may be called scenic painting, we had in the next place to consider the best mode of architectural treatment. The nearest architectural parallel to St. Paul's is no doubt St. Peter's at Rome. Here, to quote Mr. Oldfield, "Sixteen "ribs, radiating from the lantern as the centre of the cupola, run, like meridians of longitude

"from the poles of a globe, down towards each pair of pilasters in the drum. The sixteen "spaces between the ribs descend in like manner over the windows between the pairs of pilasters. "This arrangement at once establishes an architectural continuity between the cupola and the "drum." In St. Paul's there are but eight divisions also formed by coupled pilasters. We in like manner carried up single ribs to form the divisions, Thornhill's double pilasters being rather heavy in effect. Having thus obtained a suitable frame, our next step was to arrange the filling-in in accordance with the subject chosen—the Te Deum, for the selection of which I have already given the reasons. Believing that, at the great height at which the pictures would be seen, groups would not be very distinctly visible, we decided to present the figures as much detached from one another as possible and on light grounds, and to give them architectural backgrounds, a practice universal in the works of the great decorative painters. Such may be seen in the earliest Christian mosaics in St. George's at Salonica,* in such mediæval works as the paintings in the Spanish Chapel at Florence, and in innumerable frescoes by the Italian artists of the 15th and 16th centuries. Hence we adopted the podium and colonnade. Thus the architectural treatment and the subject were in accord, and the figures so to speak fell into their proper places. The prophets occupy thrones at the bases of the ribs, the martyrs stand between them in front of the podium, the virgin martyrs between the columns above; for this division we had an example at Orvieto. An apostle is enthroned in the centre of each division. In each of the four opposite bays we have proposed to place two apostles' double thrones, for instance St. Peter and St. Paul, St. Simon and St. Jude, &c., so as to include the whole twelve. At first we had intended to fill the whole space above the colonnade with a host of angels as in Gaudenzio Ferrari's cupola at Sarronno, but on consideration came to the conclusion that there would be a want of distinctness which we were particularly anxious to avoid; hence the present arrangement. In the half circles above the angels are the Holy Innocents, the Seraphim in the spandrils, and the Cherubim in the circles round the lantern.

Such were the principles kept in view by the authors in the preparation of this design. Now I mentioned that Mr. Oldfield had, from his observations of various Italian churches, arrived at certain conclusions as to the objects that should be kept in view by the designer of the decorations of a dome. These I will briefly enumerate, and you will perceive that we have so closely followed them that it might have been reasonably supposed that we had had his pamphlet in our hands while at work on the design, though the fact is we never saw it until after our drawing was completed. He says that the designer should in the first place endeavour "to set off the size and form of the dome itself by appropriate treatment of its surface. "Secondly, and so far only as the position adequately allows, to suggest by figure subjects "such a tone of thought as accords with the purpose of the building. Thirdly, to gratify "the eye by combined richness and harmony of colour." He proceeds to say that "for "the second, or religious purpose, nothing can be more effective than an overhanging array "of simple, solemn figures, looming above like spirits, watching the worshippers below." The chief rules he recommends to be followed in order best to apply the decoration, in order to set off such an architectural feature as a dome, are:—1. To arrange all the subjects in formal, if not actually geometrical, compartments, distributed equally around the

* See Texier and Pullan's *Byzantine Architecture*, plates 30 to 33. Lond. 1864.

vault in accordance with its structural uniformity. 2. To keep the most important subjects in the lowest part nearest the eye. 3. To make the number of figures give the idea of space. 4. To keep the scale of the figures at once large enough to secure distinctness to each, yet small enough not to damage by comparison the size of the vault.

Our design was commenced in the autumn of 1878, soon after the publication of the Sub-Committee's Report, and completed in the Spring of 1879. As soon as it reached London, in the summer of that year, I called upon various members of the Committee to explain the reasons that induced us to bring it forward, expressing a hope that it might receive due consideration from them. They received me most courteously, but said that their hands were tied by their present agreement. At the same time they acknowledged that we had a perfect right to place our design before the public. I accordingly arranged to exhibit the drawing in the Egyptian Hall, where it was seen and approved by many who were capable of forming an opinion upon works of art. After waiting almost three years, a part of the modified design ordered by the Sub-Committee was exhibited at the Royal Academy. I subsequently wrote to the Secretary of the Executive Committee expressing a hope that, as the design ordered by the Sub-Committee had been publicly exhibited, I might be allowed to submit ours to the Executive Committee. In reply he stated that I might do so, but that the Committee would not meet until next year. Meantime probably the model of the design ordered by the Sub-Committee will have been exhibited *in sitû*, and possibly accepted in default of another; hence the necessity of my bringing the subject before my colleagues.

I will ask leave, in conclusion, to read the lucid account of this design, written by my late lamented and accomplished friend, as follows:—

In the belief that the Dean and Chapter of St. Paul's, or their representatives, the Committee appointed for the supervision of that important undertaking—the decoration of St. Paul's—would be willing to take into consideration suggestions from any source, so long as they are founded upon true principles of art, supported by adequate designs, we offer a design as a contribution towards the solution of the problems which present themselves, whether the appropriate embellishment of the dome or the development of religious or monumental art. For many years we have studied in Italy and elsewhere the most celebrated decorative and monumental works of great masters of art, in buildings of different ages and styles, dedicated to the service of religion. Throughout the whole of these, certain leading principles of design are maintained and exemplified, and monumental painting—that is, painting connected with architecture—is characterized by fixed conditions and qualities in early as in late examples, so that, if rightly understood, even the rude, ancient mosaics of St. Mark's, Venice, convey lessons which may be of the greatest use to the artists who may be employed in so comparatively recent a building as St. Paul's.

The design which we exhibit is an attempt—under the guidance of the works of old masters, who at different periods have exemplified the true nature of monumental art—to illustrate the character of this highest branch of design, in composition, colour, chiaroscuro, and such linear or aërial perspective as may be admissible under its conditions.

The figures must be incomparably the most important features occupying the greatest space in any scheme; but those in our drawing are only typical and illustrative of a suitable subject and of certain elements of design. We think that for the actual execution in the dome they should be designed by an artist of the highest order, able to give them perfect form, religious expression, and sublimity or grace, as may be required in different portions of such a work. Our object is attained if we are successful in suggesting the true conditions of decorative arrangement and monumental composition and style.

We have selected a subject to enable us to exemplify the principles which we advocate. They may be made applicable to other subjects and to other general designs, but their presence never can be safely dispensed with. They approach, in important respects, the conditions of sculpture, and they are remote from those of

the picturesque. In the Sixtine and in the Farnesina, as well as in much earlier works, this sculpturesque treatment is obvious ; but in works of later date, more near by some years to the period of St. Paul's—as, for instance, in the brilliant frescoes by Paul Veronese in the Villa Mazer—we have ideas of design which, however fascinating, are best avoided, for in them the picturesque element predominates.

The Court of Heaven, as described in that grand triumphal hymn the "Te Deum," appears to us to offer subjects which individually are graphic, appropriate and impressive, and which, when united, may be brought effectually within the strict conditions of decorative art in its highest sense, presenting also pleasing images only, and free from all of a monstrous nature, which, however frequent in mediæval art, are unsuited to present taste. We prefer the expression of prayer, praise and thanksgiving ; and the subjects which we have selected appear to us to be sufficiently comprehensive, for in them the best traditions of the practice of ancient art may be combined with the spirit of modern ideas.

We have prepared a drawing*—one-sixth of the full size—of an eighth part of the dome. We propose to divide the entire circle into eight equal parts by means of ribs, richly decorated and of considerable proportions. They spring from eight thrones, on which are seated figures of prophets, which, if erect, would be eighteen feet in height. These would form noble themes for a great artist's powers of design, admitting of exalted idealism and thoughtful action, combined with religious sentiment and fervour. The angels erect over the thrones with extended wings and hands pointing heavenward, typify the union of the prophets with the spiritual world. Considered in a decorative sense only, these angels placed like statues round the dome resemble each other, yet with some variety of action, whilst their brilliant garments and wings contrast with the rich dark tones of the ribs. These dividing ribs bend inwards towards a common centre ; they have foliated capitals at their summits, supporting an arcade, over which, surrounding the aperture of the dome, is an entablature adorned, in the frieze, pendentives and arches beneath, with winged cherubs, seraphs and appropriate decorations of the usual forms and colours. We are unable to show the section of the visible portion of the outer dome or of the lantern ; but we contemplate brilliant gold grounds to contrast with the azure beneath, embellished with heads of angelic beings, and in the summit of the lantern, as apex of the design, the Lamb as usually represented in Christian Iconography.

The spaces between the ribs are occupied in the lower portions of the curve of the dome, with an architectural composition in two zones consisting of a podium or basement with a corridor above, intended in some measure to recall, but with much simpler forms, the general design of Sir James Thornhill, which may have been approved by Sir Christopher Wren. This structure, with a baldacchino in each central space, is meant to serve as background to the figures which throng this portion of the cupola. An apostle is enthroned under each baldacchino.

"The glorious company of the apostles praise Thee."

The martyrs are grouped on each side, and in front of the basement

"The noble army of martyrs praise Thee."

The architectural forms, the ascending aërial perspective of which we have graduated with much care, relieve against the pure azure of the whole upper curvature of the dome, on which we depend in a considerable measure for the beauty of this part of the design. As the azure descends, it becomes paler till it melts into pure white—

"La luce eterna, che soli in Te sidi."

On the surface of this azure are arranged, rank above rank,

"Angeli festanti
Ciascun distinto e di fulgove e d'arte,"

illustrating the verse of the hymn—

"To Thee all angels cry aloud."

Recalling an arrangement in the cathedral of Orvieto, it occurred to us, in this also following more ancient examples, to place the virgin martyrs apart. They stand under the corridor ; but we would again remark that these figures are not arranged in a final and arbitrary manner. Our design is a first composition in which we have been more impressed with the importance of demonstrating the great leading principles of monumental and decorative art, than in fixing any precise selection of verses from the hymn itself in this first essay. We have introduced angels and other powers of heaven, apostles, prophets and martyrs, as appropriate and as

* This drawing, or more correctly this oil painting, was exhibited to the Institute on the evening when Mr. Pullan read his Paper, and it was afterwards reproduced, in black and white, in *The Architect* newspaper for the 3rd February 1883.

eminently suitable for pictorial or decorative treatment; but we are conscious that other noble themes present themselves, especially the verse, "The Holy Church throughout all the world doth acknowledge Thee." This subject, but for press of time, would have received our earnest attention and study, for when we consider the vast extent of the British empire, and the number and variety of races under its sway, we are sensible of the fitness of recalling in our principal national temple the great national duty of the gathering-in of these peoples, and the verse which we have quoted offers a magnificent subject for illustration, and for introducing members of various races of mankind to be

"Numbered with Thy saints in glory everlasting."

We, however, propose that "The Holy Church throughout all the world" shall be represented by processional figures of various periods and costumes on the drum of the dome below the windows.

In further illustration of our views we would express, in the briefest terms, the principles which we seek to inculcate in respect of composition, chiaroscuro, colour and perspective. Before doing so, however, we would approach one subject of consideration of a difficult and delicate nature, but which is of incalculable importance, and that is, the absolute necessity of the predominance of one leading mind in the direction and execution of such a work. The history of every great scheme of monumental decoration shows how necessary to complete success this predominance really is. There have, indeed, been periods when artists painted with so close a resemblance to each other in their ideas of composition, form, and colour, that the union of several in such a work was possible without, or at any rate with very little, sacrifice of unity; but with the change of ideas, which occurred at the close of the fifteenth century and the commencement of the sixteenth, the formation of marked variations of style in different men of genius made the fortuitous union impossible; but unity being considered an essential condition, the employment of these masters even led to the destruction of many interesting and beautiful works to insure it. At times it may be acknowledged with more loss than gain to art; but in the case under consideration no such cruel destruction is needful towards the maintenance of a principle which is sound and of vital consequence. In modern days, and in England especially, artists employed in the monumental decoration of an interior, in itself perfect in architectural unity, have painted not in union but in rivalry.

In happier times historic pictures and painted decorations would have been the work of one master, who would also have designed the painted windows. Thus in the Strozzi Chapel, in Sa. Maria Novella, Florence, the frescoed pictures and arabesques are by Filippino Lippi, and he undoubtedly designed the beautiful painted window. In another chapel of the same church, the frescoes are by Orcagna and his brother. The altar-piece is a celebrated work of Orcagna also, and the window is evidently the design of the same master.

St. Paul's, begun and finished by one great architect, is our grandest example of complete unity of style; let us earnestly hope that this may be maintained in its adornment.

Composition.—Much might be written on this vital subject did space permit. Allusion has been made to the resemblance which true monumental painting bears to sculpture, when united in intimate relation with architecture.

We have divided the dome, in our design, into eight great compositions, but regarded in the aggregate they form one united picture, encircling the entire inner space. We think, and in this we are supported by the example of the greatest masters in art, that any series of subjects containing unequal numbers of figures, with varieties of backgrounds and accessories, would destroy the vital principle of unity in the entire design, substituting a succession of disconnected pictures in discord with the harmonious accord of the architecture, and from the differences in the themes and numbers of parts impossible of union. No such incongruity is ever found in really great works of monumental art. The groups visible from a central point must either resemble each other in general external forms and proportions, or must present fixed alternations, repeated at regular intervals with similar numbers of parts. For instance, the general shape of the compositions in the spaces corresponding with the four chief points of the compass might be parallelograms, whilst the four others might be pyramidal, or of some other appropriate outline. Michael Angelo has shown us, in the vault of the Sixtine, how compatible such fixed general forms of composition are with variety of design in the separate figures. Tracings of the entire external contours of whole groups show how he adhered to the decorative principle, whilst he exemplifies in the individual figures the inexhaustible resources of his invention. In thus alluding to his work, as our example, we do not point to or advocate any imitation of his manner or of his "terribile," still less of his ideas of religious expression—all such attempts have invariably failed. It is only to principles adhered to by all the great masters, and nobly illustrated by his practice, that we draw especial attention in contradistinction to those prevalent at a later period, and too common now. We have preferred the simplest profiles of comprehensive form—thus the chief groups are bounded by parallelograms—because

these appear to us to be most in unison with true grandeur of design; but to prevent this parallelism from degenerating into stiffness or monotony, and to serve as contrasts, the groups of angels have been arranged on curves of various sections.

CHIAROSCURO.—In a dome imperfectly lighted, the most urgent consideration is that light should prevail throughout the design. This we trust that we have attained. The dividing ribs, with their varied parts and ornaments, we propose should be forcible in their general effect of chiaroscuro and tone, contrasting with the brilliant spaces between the abodes of "Light eternal." Pictorially considered, the chiaroscuro in these parts hardly goes beyond that characteristic of bas-relief, so as to preserve and mark the distinctness of the figures, ever an essential quality of true monumental art. Thus the works of the greatest masters of the best times are remarkable for the prevalence of well-defined forms, so that the figures are clearly discernible when seen from a distant point. There is an avoidance of picturesque contrasts of light and shade, and accidental effects of chiaroscuro sometimes found in the barocco designs of a late date, which confound the graces of well-considered composition, and relief is obtained by contrasts of colour rather than by those of light with shadows, which would be inconsistent with the representation of the regions of the blessed. This thought is much more beautifully rendered in the designs of mediæval masters than in those of more modern date.

COLOUR.—A clear bright colour is ever characteristic of old works of decorative art, the shadows represented by local colour in all its purity, the gradations towards light being obtained by the addition of white till the pure lights are white. This Tuscan method is particularly alluded-to because, if the pictorial designs for the dome are to be executed in mosaic, all experience points to this as the best system of colour. In fresco, wherever brilliancy is to be desired, the same general principle holds good of working up from the local colour in its intensity in the shadows to nearly white in the lights. It may be a simple and primitive method, but for well-defined decorative art, in its highest sense, it is a most effective one. It is also of the greatest consequence that there should be a carefully-calculated balance of colour harmonies, similar colours in equal or nearly equal quantities, recurring at measured intervals, like the rhymes in poetry, helping to bring successive portions of the design in equal time to the eye. In a great circle of subjects this is especially important, and will require the artist's earnest attention and serious thought. The whole question of the harmonious and rythmical balance and recurrence of colour in subordination to the highest principles of monumental art, shows how necessary is the unity of mind to the insurance of unity of design, and how important is the selection of subjects capable of being regulated by such laws of colour. The recurrence of colours at fixed intervals, it may be observed, should be limited to the horizontal zones; care must be taken to avoid them in the lines of upright curvature, because the gradual passage from the powerful colour of the lower part of the design to the aërial tones of the upper part, meant to increase the apparent dimensions of the cupola, or at all events to avoid all risk of their seeming diminution, prohibits the repetition of colours in a decorative sense with equal vividness between the base and the apex. It is by a careful distribution of colour that well-considered decorative forms are accentuated.

PERSPECTIVE.—The proportions of the figures are diminished as they ascend to increase the idea of space. Having worked out the design in Florence without any section of the cupola on an adequate scale, which we were not so fortunate as to procure, we have been placed at a disadvantage; but, under any circumstances, any design which might be selected must be regulated as to the proportion of the figures by careful study within the dome itself and by measurement. Assuming, as a basis of proportion, the figures of Evangelists already executed in the pendentives, the perspective diminution of those above may be easily fixed. Perspective lines in the general composition are reduced to a minimum, and have been suggested by the experience gained in the Sixtine Chapel, with allowance for the different form of the cupola of St. Paul's. It seems obvious that whatever is done towards the arrangement of the colouring of the proposed decorations, the question of the presence of painted glass must be carefully considered. When St. Paul's was built, glass painting in its noblest forms and happiest methods had disappeared, and a style prevailed which would hardly be imitated now. If brilliantly-coloured windows are placed in the Church, any scheme of painted or mosaic decoration must suffer by contrast. In a building such as St. Paul's, filled with sculptured monuments to men honoured by the nation, such windows, by diminishing pure daylight, must also injure the effect of the sculpture in a serious manner. Many examples of this might be quoted, in which the nobler has been sacrificed to the inferior art, and the chiaroscuro of sculpture entirely spoilt. The desirableness, at the same time, of a certain amount of coloured decoration in the windows to associate and harmonize them with the polychromatic decorations of the walls is apparent.

Incomparably the best method of attaining this with grace and propriety, as well as of admitting a sufficiency of pure light to illumine the sculpture, and the paintings or mosaics, would be the adoption of the

beautiful style developed in the School of Raphael, sanctioned by Michael Angelo, and exemplified in the windows of the Laurentian Library at Florence. Such windows should unquestionably be designed by the artist of the mural decorations. The sooner the prevalent system of employing many entirely independent designers and executants in one edifice, which has been the rule in England, is given up, the better for art, and the better for our credit generally. This opinion points to another condition of like importance—namely, the training of assistants by the Master or Masters employed on public works. Invaluable as a means of education, equally so as the only method by which the expense of public work can be brought within reasonable limits, it is a misfortune that a system which has existed in Italy from before the time of Cimabue to the present, which is so universal in most Continental countries with such excellent results, should be so little practised in England.

By the right direction of a national work like the decoration of St. Paul's, it might be established to the benefit of art, and the general diffusion of public employment amongst a people so wealthy, so well disposed, but almost without the instrumentalities which have made other nations so rich in monumental art.

IV. AMERICAN ARCHITECTURE FROM A CONSTRUCTIONAL POINT OF VIEW. By Arthur J. Gale, *Associate.*

[Read on Monday, 18th December 1882, Ewan Christian, *Vice-President,* in the Chair.]

At the invitation of the Council I venture to bring before a meeting of the Institute some account of my tour as holder of the Godwin Bursary for 1882—the first year of its existence. I feel obliged to admit my inability to do justice either to my subject, on account of its extent and its varied nature, or to the occasion of a first appearance in this room. My tour, as previously indicated, covered a great deal of ground, and it will be possible to refer only superficially to most of the subjects investigated. My stay in New York was comparatively a long one. Vast buildings let off as offices are one of the sights of the City, the most recent one generally outshining its predecessors. Foremost among these stands the Mills Building. It has three street frontages, one of about 160 feet to Broad Street; one of about 96 feet to Exchange Place, and a third of about 30 feet to Wall Street. It consists of a large square main block fronting Broad Street and Exchange Place, and a long narrow wing running off at the back to Wall Street. There are public entrances from each of the three fronts, besides private entrances to the larger offices on these main fronts. There are nine storeys above the ground floor, and cellars below it. The ground, first and second floors contain (besides entrances) large rooms suitable for banking houses, with conveniences, &c. attached; the cellars are devoted to storage, safe deposits, vaults, ranges of w.c.'s, mechanical arrangements for elevators, heating, &c. The floors from the third upward to the ninth contain smaller offices in sets, divisible by means of doors into holdings of almost any size. Upon each floor are conveniences, easily accessible, grouped at different points, and a small room containing a sink. Most of the offices have a lavatory basin attached, and some have fire-places as well as the use of heating apparatus. Gas is laid on to all the rooms at several points in each. Returning to the ground floor, the main block is bisected by the large entrance hall, two storeys high; at the end of which are the square roomy elevators, four in number, in one group, constantly running. They go right to the top, and have, above them and the topmost floor, a smaller two-storey attic containing the water tanks, gearing, &c. The two-storey entrance hall, with a well for light to the lower storey, has a glass roof; a broad flight of stairs, with gangways on either side, leads to the upper or first storey, and lands close to the elevators, from which, on each floor, radiate the corridors with offices on either side, fronting partly into the streets, partly into the light and air space over the entrance, and partly into special courts for light. There is a single staircase communicating with the whole of the upper floors above the first storey, at which latter level also is the only entrance from Wall street; the Broad Street and Exchange Place entrances being on the floor below. The further disposition of the plan explains itself, but it should be added that an additional pair of elevators is placed near the Wall Street entrance. The heights of the storeys are: cellar floor 9 feet, ground floor 13 feet 8, first floor 17 feet 8, second floor 16 feet 10, third floor 15 feet 8; five storeys each 12 feet 8, and one storey 10 feet from floor to floor.

With regard to the general materials of the building: the walls are of brick with red brick facings and stone dressings. The use of terra-cotta panels gives a certain richness together with that business-like plainness which is suitable to an office building, while the general design is a simple combination of vertical and horizontal lines, the main piers being carried up as pilasters, and shadow obtained by breaking-up the piers into two or three square reveals. The result is certainly successful and pleasing. The treatment of the detail generally is classical. The roof is flat, carried upon rolled-iron beams filled in with flat arching in hollow terra-cotta arch bricks; upon this a surface of asphaltic cement is laid, then four or five layers of roofing felt, each laid and finished in asphalte; finally the roof covering of bricks, either flat, or, as in this case, edgeways, is laid in Portland cement. The patentee, Mr. T. New of New York, recommends English or German cement, one part to two of sand. I may add here that the bricks are of course the hardest and soundest to be procured, and the best judgment that can be obtained upon these roofs is their use in New York in almost all recent buildings of large size which have flat roofs, and they are numerous. The same patentee has also a marvellous cure for damp cellars. I saw it applied in the lowest and dampest riverside part of New York, and having had all the particulars supplied to me, I feel confident that its apparent success is also real. The main staircases in the Mills Building (not the entrance flight, which was not in position when I was there) are entirely of cast-iron, except the treads, which are of slate, in large slabs, about $1\frac{1}{4}$ or $1\frac{1}{2}$ inches thick. Iron takes the place of wood in the construction of newels, strings, risers, balustrades, &c. The slate landings are in two pieces, resting (with the underside visible from below) upon the cast-iron bearers of small deep girder section which run from riser to wall. The internal partitions of the building are of hollow terra-cotta bricks, which are corrugated to receive the plastering. In the corridors the walls and ceilings are plastered, and the floors tiled; this allows of good washing, and to preserve the handsome hard wood dados (3 feet high) from decay, they have a strip of marble 4 inches high as a plinth to the skirting. There are also holes at intervals to carry off the water during cleaning. Mr. George B. Post, the architect of the building, kindly went over it with me, and procured me a copy of the letting plans. I understand that the drawings for the work were prepared, and the whole building was completed ready for occupation, within twelve months from the time of receiving instructions. I forget the time occupied in preparing the actual sketches and contract drawings ready for starting, but it was a very short period, and the whole performance illustrates the rapidity of execution required in America when great commercial interests are at stake. Had the building not been ready by the specified time, the delay would have occasioned very heavy loss to the proprietor, Mr. D. O. Mills.

The heating of the building is by steam on the direct radiation system, and the radiators or coils stand in the various rooms, and form a not inelegant feature. The system of direct radiation, as against indirect, is on the whole, as far as I can judge, the more popular in America, at all events for large buildings, and its advocates claim for it the healthy feeling of heating by open fires, or by the sun's rays, namely, the direct communication of the heat to the occupants of the room, by passing the heat through the air to the body without injuring the air for breathing, and thus avoiding the noxious effects of the influx of warm air at a high temperature.

*The Apartment-Houses of New York.**—Exorbitant house rents, and the small accommodation given in exchange, have led to the provision of immense sets of apartments or houses-in-flats, some eight or nine storeys high, constructed in the most elaborate manner, and with all the conveniences that modern house construction can command. Moreover, the bad state of tenement houses or flats for the lower classes had long occupied the attention of many who were anxious to improve the sanitary condition of the houses of the poor, and an Act was passed in 1867 (since amended in 1879 and 1880), with the intention of regulating the construction of such buildings as to their ventilation, the lighting of their rooms, and the sanitary arrangements generally. The New York Board of Health has the care of the enforcement of this Act, which has no doubt done a vast amount of good. Plans of all proposed tenement houses must be submitted to the Board before beginning to build: unsatisfactory plan and arrangement is noted, and correction required. Copies are kept of the approved plans, and the careful attention of a staff of inspectors is daily directed during execution to the enforcement of the law. To the careful way in which copies are kept of the plans submitted I owe the opportunity of exhibiting prints of many of the New York tenement and apartment houses.

The higher class of houses-in-flats, known as the apartment-house, is subject to the same restrictions, though naturally there is not the same tendency to overcrowding, and to the construction of rooms without windows, &c.; indeed, these large buildings are carefully planned to give the utmost comfort and seclusion to each tenant. They have fine entrance halls, and a spacious elevator close at hand with an attendant. The elevator itself is fitted with cushioned seats, is finished with fine hard-wood joinery, and it holds six or eight persons; it runs easily, and stops without jarring. The elevator, or the stair if preferred, gives access on each floor to the main hall of that floor, and this again to the private hall of each apartment. The form of the latter makes a great difference to the comfort of a dwelling—long halls, even if wide, are unpleasant and often dark. The best arrangement is given by grouping round a compact hall, hardly more than a large lobby. The servants' department is kept rigidly apart. In the best recent cases the buildings surround a court, to which a drive gives access for tradesmen to the foot of the servants' elevator, and by this the provisions, &c., are raised to each floor. The drive is best when covered over with a substantial asphalte roof, on iron beams, with openings for light. The upper court forms a carriage drive to the entrance doors, and is often laid out as a garden.

The floors are mostly fireproof—iron beams and hollow arch-blocks—and upon these is laid the wood floor on wood bearers, bedded in cinder concrete. The floors are sometimes single, but mostly double thickness. Most of these buildings seemed to be of brick with stone dressings, some of the bricks and brickwork in America being finer than I have seen elsewhere. Their roofs are mostly of iron filled-in with light hollow lime of teil fireproof blocks, and the slates nailed upon the latter—unless a brick roof is used as before described. The wood finishings are generally good in design and the woods excellent; the variety of woods obtainable gives opportunity for superb joinery.

The heating is generally by steam (direct radiation), and fireplaces are provided as well. The cellars contain the boiler for steam heating, hot water service, and motive power to the pumps for filling the elevator tanks in roof, the elevators being mostly hydraulic.

* In my Report (page 57) I have entered somewhat fully into the details of this part of my subject, and have added plans and other illustrations of Apartment-Houses recently erected or in course of erection.—A. J. G.

Some of the apartment-houses are built by associations of intending occupiers, who agree to erect and finish their own dwellings. This seems to reduce materially the annual outlay or interest in investment, and gives the tenants a voice in choosing their neighbours. The right of choice of rooms is put up to auction among the associates. Taken as a whole, the New York apartment-houses form a very suggestive study in many ways.

Plumbing and House Drainage.—This is managed much in the same way as under the Tenement House Act. The Plumbing law dates from 1881 only, and under it all plumbers have to register their names and residences, and communicate particulars of all work proposed. The rules published are fairly representative of the opinion of the country on drainage matters. The chief point peculiar to English views is the material of the soil pipes, which are universally of iron, the joints caulked with lead and oakum, or iron cement. The pipes must be coated inside and out with coal-tar pitch, applied hot. The other rules do not differ very materially from the more elaborate views held by English sanitarians, but there is a thoroughness about the inspection and attention to minor details which is considerably in advance of the average English Local Board arrangements on the subject. The use of iron for the main lines of vertical pipe, and for the main drain till it reaches the sewer, allows of its suspension to the ceiling of the cellar, with a cleansing-cap at the junction with the soil-pipe. Lead as a material for soil-pipes is unhesitatingly condemned as inferior to iron (when tarred or, as is frequently the case, enamelled) on the score of smoothness, non-corrosiveness, and sound jointing easily made, the latter both in long lengths and in connection of fittings. In the prevention of syphonage, moreover, by ventilation of all traps, great care is taken, and American views seem to agree in the main with Mr. Hellyer's book on this point.

The Durham House Drainage Company of Chicago, working patents granted to Mr. C. W. Durham, goes even further, and contends that as it is thought worth while to convey saleable coal gas in screw-jointed iron pipes to prevent leakage, so the best means of confining sewer gas must be by the same means. Hence the use by the Company of wrought-iron vertical soil-pipes, coated with coal-tar varnish, and screw jointed. The horizontal pipes are cast-iron with lead joints. It is claimed that this prevents all possibility of breakage of joints from the settlement of walls, as the vertical pipes stand alone upon their base and carry the weight of w.c. apparatus as well. This system is in use at the town and works built by Mr. Pullman, of "Sleeping Car" fame. There is, in fact, a large amount of activity in sanitary circles in Boston and Chicago, as well as New York, and in each there is some divergence in detail, but an agreement on the main points.

The Ventilation of Buildings.—Owing largely, I presume, to climatic extremes, this has been much considered in America, and notes upon two good examples in New York may therefore be interesting. One of these is the Fifth Avenue Presbyterian Church, better known as Dr. John Hall's Church, of which Mr. Carl Pfeiffer is the architect. The site is 100 by 200 feet, the auditorium 136 feet by 85 feet extreme dimensions, and 60 feet high to ceiling. The seating is for 2,000. A tower in one corner of the site, 100 feet high by 16 feet square, is the fresh air inlet, down which the air, passing over a spray of water at the bottom, for cooling if required, is drawn by the fan. Ice can be used if necessary. The fan drives the air over a set of steam-pipes adjoining, for heating in cold weather—these are in four independent coils, for use as required. In addition, steam-pipes 9,000 feet long in all, are

hung to the wood floor of the church above—they warm the floor itself, and also the air as it passes. In fact the whole basement to which the air passes after leaving the fan, is a warm air chamber, from which the air is admitted to the pews through ventilators regulateable by the occupants in the risers of the pew ends, and of the foot-boards; twenty-four hours before service-time is allowed for the heating of the basement by the steam-pipes, at service-time the steam is turned off, the fan is started, and kept going till the last service of the day is finished, so as to flush out the air between the services. The whole basement can also be sprinkled with water, to lay dust and cool the air. The fan is 7 feet diameter and 85 inches wide, and can deliver 30,000 cubic feet of air at 220 revolutions per minute. It delivers the air into tin trunks, which distribute it from their mouths at the various points required in the basement air-chamber, and to the shafts which convey it to points in the gallery similar to those on the ground floor. The air in the church can be renewed every fifteen or twenty minutes, at a rate of 2 to 3 feet per second. The windows are all double, and between these are placed gas-burners for lighting the church—by this means the foul products of combustion go away and take with them also the foul air caused by the breathing of the audience. Other gas-burners are all within inclosed glass niches, provided with ventilating exhaust-shafts. In the basement before referred-to, the apparatus, besides fan, and steam coils or pipes, consists of two fifty-horse boilers working the low pressure steam-heating pipes; also a steam pump for filling the tanks for water supply to the organ bellows, and to the fire hydrants. The cellar has a Portland cement floor, and brick walls lime-whited. The large exhaust-shaft for the auditorium is contained in the tower at the opposite corner of the building to the inlet shaft, and a large space above the wooden coved ceiling collects and delivers the various exhaust ventilators into the main shaft. The building is not intended to be fireproof—the auditorium floor being on wooden joists, beams and storey posts. The church was stated by Captain Douglas Galton, after an inspection, to be the best ventilated church he had seen.

The same main principle has been carried-out in the Madison Square Theatre, a not very large but a very successful house, of which Messrs. Kimball and Wisedell are the architects, but there are a few points in which the detail of the apparatus is more elaborate. The inlet as in the last case, is by a descending flue, which is 6 feet square, lined with wood; in this a conical cheese cloth bag, 40 feet deep, filters the air, which next passes over ice in summer, four tons in all being used each night, two tons before and two after the air passes the fan at the bottom of the inlet shaft. The fan passes the air into a brick duct, from which sheet-iron pipes lead the air into four brick casings, which surround the steam radiators (for heat in winter). The auditorium has four sections of ninety seats each, and from the steam chambers direct to each of these seats, a 4-inch tin circular pipe conveys the air. Besides these, special ducts from the fan are used in summer to pour an extra supply of cooled air to various parts of the auditorium. All the gas-brackets and chandeliers are encased in glass, and have special ventilating exhaust-shafts. These exhaust-shafts and others draw out air from various parts of the house by means of another fan in the roof. The foot-lights, it should be added, are ventilated by the same means. Tests have been made which prove the ease with which the system can be worked, and the good results obtained. The temperatures on one occasion at 9.30 p.m. were, outside air 85 degrees Fahrenheit, in the delivery duct just beyond the ice 70 degrees, and at the main outlet 86 degrees.

The New Public Buildings at Philadelphia.—These offices, &c., for all the public departments of the city, form one of the most interesting structures now in progress in the Eastern American States. To fully examine the building would have occupied a long time—as it was, a considerable part of my week in Philadelphia was spent in studying it. The Buildings occupy a square site of 428 feet each way, with additional projections, making the whole 470 feet by 486 feet 6 inches, nearly 4½ acres, including the courtyard, around which runs a continuous range of buildings. These include large tower on the north front; the four large entrance pavilions on the four fronts; the central courtyard, 186 feet by 220 feet; and the four corner pavilions at the angles. These last contain two additional entrances each, with broad easy stairs to all floors. The basement storey or ground floor is 18 feet 3½ inches in height, all above the street pavement. It is of fine white granite, giving the effect of a strong sub-structure for the rest of the building. The superstructure contains a principal storey of 33 feet 6, and a second storey of 35 feet 7. The centre pavilions contain another 26 feet 6 storey, and an attic above, 15 feet high. The third storey of the wings, flanking these last, is 24 feet 3 to the top of dormers. The roof gives an additional height of 17 feet 3, or a total to the storey of 41 feet 6. The portion between these and the corner pavilions is a little less in height. The large tower before-mentioned is to be 535 feet total height, 90 feet square at the base (where the walls are 22 feet thick) built of dressed dimension stones, 2 to 5 tons each in weight; and it stands on a bed of concrete 8 feet thick and 90 feet square. The statue of William Penn, 36 feet in height, is to crown the whole, which, it is stated, will be the highest artificial construction in the world. The superstructure is composed entirely of white marble, from quarries at Lee, Berkshire, County Massachusetts. Besides the double entrances in the corner pavilions, there are ample public staircases in three of the four centre pavilions; and four large elevators at the corners, where the corridors intersect, give access to every floor. Every room in the finished building will be well lighted, warmed and ventilated.

The system of warming and ventilation is that known as indirect radiation, and the portion in operation in June last was that for the eastern half of the building only. The external air from the courtyard is drawn by a fan in the building through fresh-air ducts, and passes immediately into the passages, which in the cellar floor take the place of the main corridors on the floors above. These passages, or warming-chambers, contain stacks of steam radiators at frequent intervals; thence, when heated, the air passes by flues in the brick walls, which communicate with the rooms. The fan is 12 feet in diameter, and forces 855 cubic feet of air per revolution; a 20 horse-power engine drives it up to 120 revolutions per minute. The steam for the radiators is generated by six boilers, each 5 feet diameter and 14 feet long, and they are in nests of three, so arranged as to work in combination or separately. The impulsion of warmed air is relied-on to drive out the vitiated air, which is done through outlets near the floor of every room communicating with brick exhaust-shafts arranged round the boiler-flue and discharging 170 feet above the ground. These outlets in the floor of the rooms seem to be in the wrong place, though in America it is a frequent, but not universal, position for them.

The floors of the building are of rolled-iron I beams, and 4-inch hardbrick segmental arches, with an extensive use of immense built girders. It has not been attempted, as far as I

saw, to make the building generally fireproof, in the sense of protecting all constructional ironwork. The roofs are noteworthy: the trusses are of rolled-iron I beams connected by iron cleets; the rafters or trusses are crossed by $\perp$ irons laid back to the rafters and bolted on. The slates are 18 by 10, all uniformly sawn, $\frac{5}{8}$ thick, and bolted to the $\perp$ irons with brass screw bolts and nuts of peculiar construction. The flashings and roof dressings are of tinned copper. The whole of the building has in fact been arranged in the most careful manner. The sculpture and carved work generally were executed from models prepared on the works under the superintendence of Mr. McArthur, the architect of the building, to whose design the first place was awarded in September 1869, in the competition which took place; and in January 1870, the building was commenced. The site is a magnificent open square at the intersection of two fine streets, and the total amount spent on the buildings up to December 31st 1879, was 5,857,618 dollars. The estimated outlay was 10,000,000 dollars, and at the date of the actual commencement of the work, in January 1871, ten years was the time estimated for the completion of the whole building.

The Post Office at Philadelphia.—This building is interesting, as a typical example of Government buildings generally. The fine granite fronts, cut and fitted entirely at the quarries, are put together on the building without the use of chisel, so accurate is the fitting. The granite for the lower storey is from Dix Island, Maine; that for the upper storeys from Richmond, Virginia. The staircase is an example of its particular type, with rolled-iron carriages and cast-iron casings and tile treads. The roof over the sorting-room, which has necessarily a large amount of glass, is constructed of cast-iron frames laid on bearers, and carefully lapped at the joints, and filled with glass bull's-eyes bedded in putty, and grouted with a mixture of coal tar and brimstone. The Philadelphia bricks used for the backing of walls in this building, and also in the New City Buildings before described, have stood a crushing test of 500,000 lbs. uninjured for five minutes; they are the usual size of American bricks, 8 by 4 by $2\frac{1}{4}$. Cast-iron is used very largely in the window and door finishings of this building. Other parts also of the construction are interesting, the idea apparently being to give as little material as possible of an inflammable nature to fall a prey to fire. Government buildings all over the United States are supervized from Washington, where architectural matters form a branch of the Treasury Department, under the superintendence of Mr. James G. Hill, who has the title of Supervizing Architect to the Treasury Department. A glance at his last annual report shows many buildings in progress, such as Court Houses, Post Offices, Custom Houses, &c., each under the care of a fully qualified superintendent, who manages all matters connected with his particular building. All drawings are made in Washington, and copies taken by a photographic process. Contracts are made with manufacturers, &c., to supply various items for the buildings, and no quantities are supplied. Payment is by the Treasury on the architect's certificate; accounts are kept separate, and payments made out of appropriation voted annually or otherwise on each building separately.

The Johns-Hopkins Hospital at Baltimore.—This hospital will be, when complete, one of the most interesting buildings of the kind. It is the result of the study and examination of the chief hospitals in Europe by Dr. Billings of the United States National Board of Health, an army medical officer of great experience and sagacity, under whose directions, as medical adviser, all the arrangements of the building have been made. Dr. Billings was selected by

the trustees under the will of the founder, the late Johns-Hopkins, to prepare a carefully worked-out scheme based on a visit to Europe. The selection was made from among several other gentlemen, who all submitted essays on the subject. All that can be of sanitary importance has been done absolutely under Dr. Billings's medical authority. Constructive and artistic matters have been looked after by the architects, Messrs. Cabot and Chandler, of Boston, and Mr. Niernsee, of Baltimore, the latter being consulting architect. The buildings occupy a site bounded by four streets in the most open and elevated part of the city. The wards are all one storey high, arranged in two rows; the wards in each row are connected by a corridor, so that each ward is isolated from its neighbour, and from its own service-rooms. The administration block is at the end of the rows of wards, with other adjuncts belonging to it congregated around. All the wards have the same aspect, their sides facing east and west; and for occasions of epidemics ample room is left for tents, &c., on spare ground. Dr. Billings, who kindly showed me round the buildings in progress, emphatically insists on hot water at low pressure for heating; as it warms by means of large surfaces at a lower temperature than steam, it can be more easily regulated and, though slower in action, is in the end surer. The hot-water coils are placed in a kind of basement storey, the whole of which is above the ground line, the ward floor being raised some 7 feet. The air is admitted below these coils, and in cold weather passed over the coils—in hot weather it is passed straight through a flue, and discharged cold into the ward, through two inlets at top and bottom of the wards. A double valve arrangement allows the air to be directed as above, either way at will. The hot-water pipes are carried from the boiler near the kitchen along the lower storey of the connecting corridor, in which also is a duct for the conveyance of fresh air from a fan near the engine-house. This fan and air-duct are used to flush-out the wards at night and in the morning. The air from this duct can be directed over the coils or not. The outlets for foul air are at the top (the ceiling being sloped to them), and have a coil to give an up-current. Other foul-air outlets at the bottom of the ward, communicating with a main aspirating-flue, were originally proposed by Dr. Billings, but I fancy they were not being executed. The materials generally are red brick facings, with dressings of Blue Cheat River stone. The roofs are slate, and all gutters, flashings, &c., flat roofs and rain water pipes, are in sheet-copper soldered. The large dome is in lime of teil blocks on iron trusses; on the teil blocks are fillets plastered between, flush with their face; on this is paper felt (asphalted building paper), and then the slating.

Iron Fronts for Buildings.—A stay of one day at Detroit, between two nights in a Pullman car, afforded some interesting particulars on this head. There, Mr. Gordon Lloyd, a nephew of Mr. Ewan Christian, is very much in favour of this mode of construction rather than stone, and he has used it to a considerable extent in the wide streets of the city. The advantages he claims are less weight during construction, and less weight afterwards; far less expense than a stone front, with the same amount of reveal surface—the amount of reveal surface well used being, after all, the chief means of gaining effect, apart from all elaborate detail which cannot always be afforded. Shadows, moreover, are in America wonderfully sharp and decided, and the air is very clear; and a small expenditure used in gaining broad shadows without carving gives far better effect than much carving and little shadow. If carving be used, it must be sharp and easily withdrawn from the mould. Iron fronts, again, are far more durable than stone, and much more water-tight, so long as due care be exercised in

construction. Particularly is attention necessary to the painting of every part, inside and out, seen and unseen; also of all bolt-holes and bolts. Large glass panes should be bedded with rubber tubes: beyond this there is no fear of contraction and expansion. Owing to the air-spaces which abound in such iron fronts, they are more equable in temperature and drier than stone fronts. The paint question, again, is an important one. Stone fronts, and those of brick also, retain dirt very much, and cannot be kept clean. Mr. Lloyd showed me three buildings all adjoining: one iron front, painted when new, still fresh; a stone one which had become dirty, which was then painted, and had again become dirty; a third in brick, which, though in its original state, was very dirty and shabby-looking. Carson's anti-corrosive paint is said to be the best for iron buildings, which after this process will last twenty years without repainting, and have lasted fifty years without further trouble. This is, of course, in the clear American atmosphere. As to constructive details, there are two kinds: buildings with a skeleton or framework of iron and a thin skin fitted-on, and those with a strong skin and no skeleton. The construction of the latter follows so closely the detail of the front that it may be dismissed without further description; but the former will require some explanation. It seems to be the better construction of the two, as the supporting portions are much more, if not quite, protected from the action of fire. In an example which I examined the fronts only were of iron—the building consisting of four storeys, with brick side, end and party walls. The sashes were of wood, and all the joints of the ironwork itself, and of that with other materials, were carefully checked or lapped. The cornices were of galvanized iron, a material frequently used for the purpose, and almost a trade in itself. The foundation wall of the front is brick, carried-up in piers to receive the round cast-iron columns which are the vertical members of the skeleton. Across these, at the first-floor level, are rolled-iron riveted girders, and above are columns again. On the floors above the first, channel irons as lintels, laid with the back downwards, are placed, all bolted together. The columns are cased with brickwork, leaving a space between the outside of the brick and the ironwork shell; on the lintels or channel irons too is 12-inch brickwork as high as the window-sills. The columns are continuous in height, and have brackets for the reception of the channel iron, which in its turn carries the floors, which are anchored to the front. The metal is about $\frac{3}{8}$ thick for the shell, which (surrounding the constructive skeleton) takes any form of detail required.

Fireproof Construction.—Boston and Chicago are both, as might be expected after their experience of disastrous fires, fully awake to the importance of this question. New York is also well to the front. Mr. P. B. Wight, originally an architect, but now devoting himself to the management of a fireproof construction Company, gave me some interesting particulars. His motto is: "No building can be fireproof unless all constructive ironwork is protected." But if ironwork be not used they protect the wood floors—in fact, they prefer this method. The joists are carefully guaged as to distance apart, varying with the thickness of joist, so as to allow of deafening with brick laid on fillets like ordinary pugging. This is carefully bedded in fine concrete, and the whole covered with a tile, concrete, or boarded floor. Underneath is fitted a ceiling of porous terra-cotta, or cement tile. Counter sunk recesses receive a plate of iron, which is screwed into the joist, thus clipping the terra-cotta or tile to the joist; two adjoining tiles, all laid dry, are thus supported. The joints are then pointed in plasterer's stuff, and the plastering finished in the ordinary way. The additional weights, over and above

ordinary construction, are, floors 12 lb. and ceilings 8 lb. per foot. Fifteen to eighteen per cent. is given as the extra cost above ordinary non-fireproof construction, and, as will be seen from the Company's prospectus, existing buildings can have this method adapted to them. Furring down on the joists for the ceiling-tiles is sometimes used. The stair aprons and strings are all similarly protected, the wood treads alone being exposed, and all the decorative finish being in Keene's cement. If rolled-iron girders be used to carry the joists, they are protected with porous terra-cotta or cement blocks, which are in two or more courses, one fixed to the bottom and one to the top flange. They are both pressed to the iron in guaged mortar, and iron holdfasts have been found unnecessary, as the blocks break first when removal is tried. Columns again, if finished 11 inches or more in diameter, are fireproofed at the same cost as cast-iron columns of the same diameter. Mr. Wight uses a webbed column of cast or wrought iron; to this fireproof blocks of terra-cotta or cement are attached by slips (such as are described for ceilings) screwed to the core of the column; these are finished with plaster of Paris, lime of teil, or Keene's cement. The above method is the recommended one, but where circular columns already exist the blocks are grooved at the top and bottom edge to receive a metal tongue (as in the case of a tongued floor); the joists being bedded in mortar, the band is protected, and forms a strong joint. These columns as described have all their ironwork covered; the covering is solidly fixed, will stand blows of falling materials, &c., and the space occupied is small. The materials described are adaptable for covering the timber work of sloping roofs with porous terra-cotta, for furrings inside brick or stone walls, in place of the wood furrings almost universally used in America; for hollow partitions, and for attachment to floors having iron girders, and segmental arches already existing.

At Albany a stay of barely one day allowed very few notes to be made; but some valuable general hints upon American as compared with English practice were obtained; among others, some from Mr. R. W. Gibson, an English Royal Academy student, now practising in Albany. The climate, he said, is a most important point to be considered, extreme heat and extreme cold having to be provided-for. The frost-line is as far down as 3 feet 6 to 4 feet 6 from the ground; open drain man-holes are thus impossible. Rain-water pipes must be carried down in warm places inside the house; half-timber work, with exposed plaster, is impossible, though frame houses entirely of wood are the best, warmest and most satisfactory. In their joinery small scantlings are used, and all parts are pieced together with small sizes. Long, deep bearing-joists are used, instead of short small ones, with binders or sleeper walls. The bond of brickwork is often very little adhered-to, with headers only at every sixth course or so. The woods of the country are superb; prime cost of these and other materials is low, but labour costly. The decorative woods used are mostly cherry, black walnut, oak, ash, maple, rose-wood, satin-wood. An idea of joinery prices may be gained from the following quotation for matched and beaded dado, fixed and finished in various woods, per foot super: second-quality pine, 7 c.; first-quality, 9 c.; ash, 10 c.; oak, 12 c.; Georgia pine, 10 c.; cherry, 15 c. The sash-frames universally have the pulley-style projecting beyond the outside lining to form a hanging-style for the outside sun-blinds, with regulateable slats.

The general impression conveyed by a tour such as the one under consideration is that American buildings are wonderfully complete in mechanical appliances, and elaborate in

construction—expensive, it is true, but the public taste seems to demand the amount of convenience, and to be willing to pay for it. As to artistic effect, the majority of the buildings are well worthy of a place beside anything we do here in England—indeed, it is hardly possible that American buildings should show, of late years, that lack of taste which, it is true, once distinguished them. The schools of Paris have received as students most of the leading architects of the United States of the present day, and to an accidental meeting in Italy between a sketching party of American architects from Boston and some of the prize-men of recent years at the Royal Academy and the Institute, I owe some of the pleasantest hours of my tour. Having, I fear, transgressed the limits of time allotted to me, it only remains for me, before closing, to acknowledge the personal benefit derived from the opportunity of visiting America, as holder of the Godwin Bursary, and my indebtedness to its founder, without whom the occasion would not, in all probability, have offered itself.

To those gentlemen who very kindly gave me information and introductions, on my leaving England, I owe thanks for the facility with which I obtained access to much that I wished to see. Of the way in which I was received, and the ample facilities given me by all Americans with whom I came in contact, I cannot speak too warmly. Where all were most hospitable, it would be impossible to mention names; but I must acknowledge the kindness of Professor Ware, an Honorary & Corresponding Member of the Institute, who practically arranged my tour for me.

[Remarks by Ewan Christian, *Vice-President*.

I have had the advantage of travelling in America, though only for a very short time, and certainly I came home very much impressed with the "go-a-headedness" of the people. No other term will so accurately describe it, in every department. One man brings out an invention, and if there be any good in it straightway the news is flashed from one end of the country to the other; it is used till something better is invented, and then that is in like manner taken-up and acted-on. They do not, like ourselves, wait to have things perfected, but try and try again. Take the electric light, for instance. How long have we been waiting, and shall have to wait, for its general adoption? But though when I visited Detroit three years ago it had not been introduced, within six months from that time it was in almost universal use! The telephone, too, is used everywhere, and for all purposes of communication, domestic or public. As regards the subject of ventilation, I spent a Sunday in New York, and went to the church which Mr. Gale has described. Its arrangements are the perfection of comfort, not to say luxury—far more luxurious, indeed, than I think consistent with the purposes of such buildings; for I do not hold with easy-chairs and orchestras in houses of prayer. According to the area given, such a church would hold, on English calculation, 3,000 persons; but Mr. Gale says it is only intended to seat 2,000. It was quite full, and the freshness of the air was very remarkable. As to the equalization of temperature, if it is required to be provided-for, you may be sure it will be carried-out to perfection in America. If we English do not know how to provide against such changes—and our practice in that matter is usually very defective—they do. All their houses are so constructed as to be comfortable throughout in the very coldest weather. When in Detroit, I went over one of the most beautifully finished

houses I have ever seen, and as perfectly comfortable as it was possible to be. It was kept throughout—rooms, hall, corridor and staircases alike—at an equable temperature of from 65 to 70 degrees, and, as I was informed, all through the winter, however cold the external air might be. Steam was used for heating, as it is to a very great extent throughout the States.

EWAN CHRISTIAN.

[Remarks by Andrew T. Taylor, *Associate.*]

I followed this Paper with special interest, having gone over pretty much the same ground that Mr. Gale appears to have done. While in New York I was greatly struck with the lavishness, and to our ideas almost extravagance, shown in the internal finishings of even moderately-sized dwelling houses. It is not an uncommon thing to hear of 30,000 or 40,000 dollars having been spent on internal finishings; the doors and doorways, chimney-pieces, buffets, and other finishings of the principal rooms, being beautifully executed in a variety of hard woods, and in a manner very uncommon with us. I had the pleasure of inspecting several of the houses now being erected, and more or less completed, in that new splendid street in Boston (Commonwealth Avenue), and neighbourhood, including Mr. Whittier the poet's house. I also had the good fortune to see over a portion of Mr. W. H. Vanderbilt's famous house in New York. The treasures of the universe seem to have been laid under contribution to minister to the gratification and display of this "railway king;" and one comes away from a brief visit dazzled with the splendour and costliness of the decorations, fittings and furniture. There is one subject referred-to in the Paper, namely, the important one of cast-iron construction in American buildings, which is of the utmost interest. At the time of my visit I was hoping to find that the Americans were developing a distinct and rational treatment starting from an understanding of the nature and limits of the material; but in this I was disappointed. So far as I could see, they appeared to be going chiefly on the old lines of stone and brick construction. I could not find any buildings which to my mind fairly met, or even grappled with, the problem. I was struck with the number of immensely high houses in New York. The development and extensive use of elevators has made such buildings practicable. No one thinks of laboriously climbing up numerous flights of stairs. There is an attendant all day long in charge of the elevators. You step in, and almost immediately step out at the floor you wish. The consequence is, that offices and dwelling-houses up four, five, or even six storeys, command much higher rents than they would do with us, other things being equal. The general impression left upon one after a visit to the other side of the Atlantic is, that the Americans, in ingenuity of plan and cleverness of arrangement, are pressing us very close, if they are not already ahead of us; and even in the region of pure Art, they are very earnestly striving after greater excellence. The result is naturally at present a little feverish, as everything American is; but better that, than stolid self-satisfaction and lethargy, for even in this "unrest" lies, I am convinced, the "power and the gateway" of great things in the future.

ANDREW T. TAYLOR.

V. THE GODWIN BURSARY: REPORT OF A TOUR IN THE UNITED STATES OF AMERICA. By Arthur John Gale, *Associate.*

[Addressed to the Council of the Royal Institute of British Architects, November 1882.]

Mr. President and Gentlemen,—

IN pursuance of my undertaking, as holder of the Godwin Bursary, I have to submit a report of my tour, extending over three months of the present year (1882), through a portion of the United States of America; and in order to convey a clear idea of the manner in which I have endeavoured to perform the duty, it will be desirable to give, in the first place, a general outline of the route pursued, and (without going into detail) a short synopsis of the chief subjects of interest which came under my notice in the cities visited. I left London for Liverpool on Friday, April 28th 1882, and on the following day left Liverpool for New York by mail steamer, arriving in the latter city on Monday, May 8th. From that date until the 19th July, I was in the United States, visiting the following cities, and remaining in each during the periods here indicated:—New York,* from May 8 to June 3 (one month); Philadelphia, June 3 to June 10 (seven days); Baltimore, June 10 to June 19 (nine days); Washington, June 19 to June 23 (four days); Niagara, June 23 to June 26 (three days); Detroit, June 27 only (one day); Chicago, June 28 to June 30 (three days); Albany, July 2 only (one day); Boston, July 3 to July 12 (nine days); Newport, R. I., part of July 12 (three-quarters of a day); New York, July 12 to July 19 (six days).

On July 19th I left New York by steamer, arriving in Liverpool on July 28th, three months from the date of my departure from London. Of these three months (or ninety-one days), twenty days were spent in going to and returning from America; and of the remaining seventy-one days, eight were occupied in travelling and the necessary arrangements, six in sight-seeing of a non-professional nature, and ten were Sundays; thus leaving forty-seven working-days. It will be seen from this outline of route that all, or nearly all, the places mentioned in the formal undertaking signed before leaving England were visited.

As to the subjects investigated during my tour, the following notably claimed attention:—

New York.—1. The apartment-houses, or houses-in-flats, there being some large examples, both in progress and occupied. 2. The plumbing and drainage, and the very strict laws on the subject which are in force in the city. 3. Fireproof construction as practised there. 4. Steam and other modes of heating in general use. 5. The office buildings of the city, particularly one large block now just completed. 6. The building regulations of the city. 7. The general use of the elevator or lift, and the methods usually adopted. 8. Two particularly good examples of ventilation: Dr. J. Hall's Church, and the Madison Square Theatre. 9. Sundry details of construction. 10. A New York suburban house.

Philadelphia.—1. The new city buildings. 2. The new United States Post Office. 3. Sundry general notes on construction.

Baltimore.—1. The new Baltimore and Ohio Railroad Company's offices. 2. The Johns-Hopkins Hospital. 3. Sundry public schools. 4. The first Congregational Church, Baltimore. 5. Sundry general constructive notes. 6. The building regulations of the city.

Washington.—1. A general study of the methods of construction in use in the Architects' Department of the U.S. Treasury. 2. General drainage regulations.

Detroit.—1. Notes on iron buildings. 2. General notes.

Chicago.—1. Fireproof construction. 2. The building laws of the city. 3. Elevators or lifts in use there.

Boston and around.—1. Building regulations of the city. 2. Notes on warehouses and store buildings. 3. Drainage at Nahat, a seaside resort. 4. Typical seaside houses. 5. Typical country houses. 6. Frame or timber houses. 7. Fireproof buildings.

Newport.—Colonel Waring's drainage work.

It has appeared to me best to take one or two of the subjects which occupied most of my attention, and seemed to offer the best suggestions for English practice, and to report on them at length—particularly as this will enable me to introduce some slight reference to many of the minor subjects which I studied in detail (such as laws and regulations affecting buildings, fireproof structures, elevators, heating, &c.), leaving these subjects to be treated more fully at a future opportunity.

* During my stay in New York, one day was spent in a visit to Albany, returning the same night.

Apartment-Houses, or Houses-in-Flats.—New York is situated almost entirely on an island called Manhattan Island, just at the point where the Hudson River flows into New York Bay. The island runs about north and south, being about thirteen and a half miles long by a varying breadth of from two and a quarter miles to a few hundred yards; on one side (the west) is what is called the North River, which is the Hudson River proper, and on the other is the East River, both being wide and deep enough for the largest vessels, with a very slight rise and fall of tide. The southern point, or extremity of the city, is on New York Bay; the northern end is bounded by a creek connecting the two rivers. This description will indicate the value of the site as a port, and the consequent influx of large numbers of persons in pursuit of a living, who follow the footsteps of commerce, to a city whose very size and partial isolation make land dear, and difficult to procure. In effect this has been the case, and the price of land has been, I believe, steadily on the increase, so that the first idea upon which the city was laid-out has been perverted, and the lots of 25 feet frontage and 100 feet depth, which were the original divisions of the land, are now few of them intact, but five and six and even seven houses have been built on four lots, giving a much greater disproportion between the depth and the frontage. This perhaps would not have signified if the spirit of the idea of the 100 feet depth had been preserved; but instead of a spacious rear garden, the New Yorker has built over nearly the whole of his lot, and thereby spoilt the lighting and planning of his house. Much needs to be said in order to indicate the development and *raison d'être* of the American or New York apartment-house; and when we take into consideration the facility of vertical communication given by the elevators in universal use, there seems to be no reason why there should be any more difficulty in access to a town-dwelling up many storeys than to a similar dwelling distant many miles. The apartment-houses visited by me during my stay in New York were the following:—The Dakota [Illustn. xxi], fronting on Eighth Avenue and Seventy-second and Seventy-third Streets; the Vancorlear [Illustn. xxii], fronting on Seventh Avenue and Thirty-fifth and Fifty-sixth Streets; the Wyoming, across the street near the last; the Hubert Home Club, in Fifty-ninth Street, between Broadway and Seventh Avenue; and the Home Club No. 7 [Illustn. xxiii], at the corner of Madison Avenue and Twenty-eighth Street. The three first are from the designs of Mr. H. J. Hardenbergh, architect. The Home Club No. 7 is the head-quarters of the apartment-house work, done under the superintendence of Messrs. Hubert, Pirsson & Co., architects of both the last two. In addition to these I collected plans and particulars of some others which afford such further information on the subject as can be conveyed by drawings, &c., without a personal inspection. Amongst these were the Central Park Apartments [Illustns. xxiv, xxv], on Seventh Avenue and Fifty-eighth and Fifty-ninth Streets. To some of these buildings I paid three or four visits; and as I was in several cases, by the kindness of the architect and others, put in possession of copies of the plans, I felt that one of the most useful ways in which my note-book could be employed would be in an examination of these buildings.

The Dakota building then in progress is an exceedingly interesting example of an apartment-house. The general principle noticeable in other large examples has been followed in the plan—a large central court surrounded by buildings [fig. 61]. This central court has a basement covered over with a flat roof of sufficiently heavy construction to allow of its use as a carriage-drive. The basement floor is used for the service of the whole establishment, and will give easy and well-lighted access for the tradespeople to the foot of the servants' elevators. The formation of this basement involved the excavation of a depth of 10 feet of earth over the whole site, at one side of which the solid rock was found 2 feet down from the road, but on the other side a depth of 35 feet was excavated under the main walls before coming to the rock; the space between the level site and this sloping bed of rock was found to be filled-up at the lowest point with a vast mass of decayed rock, and above this earth of a more or less soft nature, with a watercourse in one place in a hollow of the rock. The walls, as a consequence of this, had to be stepped down to meet the slope of the rock, and the latter levelled to receive the various steps in the footings. Nearly all the walls were treated in this way, and the trenches sheet-piled till the walls were up to the ground level. Blue stone, a very hard light blue-grey stone, somewhat like York stone, was used for the base of the walls, with high and narrow offsets, and all this work was built in Rosendale cement. For the walls of the Dakota building brick is used throughout, with facings of various kinds: on the fronts the best North River bricks from Haverstraw, with dressings mostly in Nova Scotia stone, which is of very fine texture and capable of delicate detail, and also very durable; its colour is a good grey-green, varying in different quarries. Parts of the dressings, however, are in buff terra-cotta, which appears to work very true and sharp. The front bricks are 8 inches by 4 inches by $2\frac{1}{4}$ inches—about four courses to the foot; three stretchers make 25 inches. The internal facings of the courtyard are in terra-cotta bricks of a similar nature to the terra-cotta dressings of the front; they do not work to the same number of courses as the other bricks. They give a light facing surface and are easily kept clean, and are almost entirely free from holes for smoke or blacks to lodge in, thus preventing a large amount of discoloration. The whole of the brickwork is set in Rosendale cement. The

floors are all fireproof, constructed of rolled-iron joists, with hollow arch-blocks of burnt clay, almost like fireclay or terra-cotta, laid in a flat arch, and the skewbacks arranged to protect the beams, though Mr. Hardenbergh is of opinion that the contents of any dwelling-house or room are not sufficiently inflammable, or, if on fire, not of sufficient volume, to need very much protection to the iron girder flanges. The ends of the girders are anchored to the walls by drilling a hole and passing through it a 15-inch or 18-inch iron rod. The end of the beam is then built-in. The building, at the time of my visit, was not ready for the roof, being at the level of the ninth storey. I particularly noticed the very fine views which will be obtained by the occupants of the upper storeys, as a set-off against the necessity of going so high. The storeys are many of them very lofty, the third storey (which we should call in England the second floor) being 15 feet high; the fourth is 14 feet 6 inches; the fifth 14 feet; the sixth, 13 feet 6 inches. The ventilation-flues for exit of foul air are of a somewhat novel construction; they are intended to serve for the kitchens, W.C.'s, bath-rooms and internal halls. There are no inlets of a special character, as there would be no crowding of people together in the rooms which they serve, and Mr. Hardenbergh considers them unnecessary. The heating arrangements were not decided-on when I saw the building; but even at that time nearly the whole of the apartments were let, and the rents might be put, roughly speaking, at 3,000 dollars per set. There are several matters of construction which would be better treated under a general clause on "Constructive Detail," but the roof of this building is so much a part of the design that I think it better to include it in this notice. It is, in the first place, very steep, and there are two floors in the roof, and an ample gable-space above, also floored, the two former having hardly any floor-space covered by lean-to roof. At the three floor levels (that is, at the top of the walls and at two points above) rolled-iron joists of **I** section cross the span from roof-slope to roof-slope, and on these the floor rests. The roof is straight-sided and not a mansarde. The sides are constructed as follows:—The ends of the rolled-iron joists of floors are clasped by two channel-irons, which form the rafters, and are bolted together with a thimble between; to these on either side is bolted a cleet or corbel, and on this rests, bolted to it, another **I** iron, which forms a stiffener or longitudinal brace, but can hardly be called a purlin, as it does not support rafters. The horizontal rafters, as one may call them, are ⊥ iron bolted flat downwards to the double channel-irons, and between these ⊥ irons blocks of porous terra-cotta are dropped-in and bedded in cement; on the outside of this, without further trouble, the slates are nailed, and the flats of the ⊥ irons underneath are plastered-up level with the porous terra-cotta, which is rebated to allow it to come down rather more than flush with the under side of the ⊥ iron, and affords a key on either side. Thus the iron is carefully embedded in the porous terra-cotta, and preserved from possible contact of flame or excessive heat.

The Vancorlear [Illustn. xxii] was fully occupied at the time of my visit to it with Mr. Hardenbergh. It consists of a central court for the access of tradespeople, in which court, however, no driving is permitted, as it was found, I believe, that the noise was objectionable to the tenants above.* The building takes on each floor [figs. 67, 68, 69] six sets of rooms, the corner apartments of course receiving from the two street frontages the maximum amount of light and air. The other sets are, however, in no way to be despised in this respect, as they receive amply sufficient light and air each from their one street frontage and the central court, which is spacious and well ventilated. The roof-space provides a large amount of store-room, which is divided-up, and portions are allotted to each tenant. The spaces have some of them open frame-work, for free access of air, while affording locked receptacles. For a flat portion of the roof Mr. Hardenbergh used slates laid in cement on five layers of roofing-felt, the latter being laid each of them in hot asphalte, put on with a brush. It was not, however, found quite satisfactory. The back stairs, which lead from top to bottom of the house, and connect the servants' department with the central court in basement, are of light open iron framing, and have ash treads. In the kitchens I noticed the small cooking-ranges, which have the oven at the top, its front flush with the wall, and the space for boiling kettles, &c., slightly projecting. These ranges were stated to give entire satisfaction. It should be mentioned that all the bedrooms have fixed wash-basins, recessed in cupboard framings or in a separate washing-closet, being thereby hidden from view, while still easily accessible. The wood floors are of the usual careful close-jointed character used in America, narrow-width boards of hard pine in single thicknesses. The heating arrangements are worthy of notice. Direct-steam heating is the system used—that is, the steam is carried direct to the coils called radiators, which are placed under the windows. The hot-water supply, which serves all the sets of rooms, is heated by waste steam from the boilers. One pair of these boilers at first worked the whole system of steam heating. They drove the pumps for filling the hydraulic elevator tanks, and also the pumps for filling the household water-supply

* This difficulty was obviated in the Dakota by covering the lower court with a flat asphalte roof.

tanks (these pumps being the only mechanical power used). But recently the pumps have been worked by a separate boiler, and the old boilers, which did all the work, are now engaged simply in working the steam heating-apparatus. For this 5 lb. pressure suffices, the condensed water in the steam-pipes being returned through the pipes to the boilers and re-used ; there is thus little or no waste. An artesian well was sunk to a depth of 300 feet, and fair water found; it is, however, used only for the water-power required for the elevators, and not for drinking—for this the usual Croton Reservoir supply, by meter, is found best. The roof of the Vancorlear is on exactly the same principle as that of the Dakota ; but the blocks between the ⊥ irons are solid, cast in moulds, and are composed of plaster of Paris and coke-dust, with perhaps a little shell lime.

In the Wyoming apartment-house, close by, the heating and water-supply are on the same principle as at the Vancorlear ; but the engines, &c., of the latter do all the work for the former by means of pipes under the street. The tenants deal separately, by meter, with the gas company ; but the water-supply is provided by the owner, and paid-for in the rent. The general construction is brick, with stone dressings, the excellence of the brickwork being noticeable. As to concealed construction, I have, with regard to this building, no notes, and can only state that the joinery is of high-class finish, and the woods are of equal excellence, the chief varieties of wood used being ash, mahogany, walnut and hard pine. The apartments had been finished and occupied for some time when I saw them.

The Hubert, an apartment-house on Fifty-ninth Street, between Seventh Avenue and Broadway, was being finished when I visited it, and, though in general features it is not unlike other apartment-houses, there are one or two points in it to which it may be well to refer. Plans of the house are given in *Scribner's Monthly Magazine* of April 1881. First, as to the arrangement of heights from floor to floor. The main building, or that fronting the street, contains the principal rooms, such as parlour (or drawing-room, as we should call it), dining-room, library, &c., according to the scale of accommodation and area of the respective holdings. Behind is the servants' department, containing the remainder of the holding. The two together make the complete apartment, or unit, as distinct from the collection of units known as an apartment-house. The building is a high one, containing in the front portion seven floors above the basement, which is 9 feet high, and below the basement is a sub-cellar, about 6 feet 6 high. The first, second, third, fourth and fifth floors of the front are each 14 feet high from floor to floor ; the sixth and seventh are 9 feet high. The rear block has ten floors above the basement, each 9 feet high. By this difference in heights of floors a system of "give and take" is arranged, which the architects, Messrs. Hubert, Pirsson & Co., call the duplex system. The advantage of this is obvious, the duplication of floor-space in parts where less height is required giving largely increased accommodation, by the aid of a little skilful planning. The general arrangement of the different holdings may be gathered from one example. The house occupies two ordinary lots of 25 feet frontage, with a depth of 100 feet. The full frontage is occupied by building. Taking the front part of the building first : the central feature of the whole plan is the elevator, round which winds the staircase, the two together forming the public access from floor to floor. Wide landings give access to the entrance-doors of the different apartments, which in this case are placed two on each floor. Inside the entrance-door is the private hall (with hat and coat cupboard), of peculiar, but symmetrical, shape. From this open, on the right, the library 14 feet by 9 feet; in front, the parlour 12 feet 6 by 22 feet; and to the left the dining-room 12 feet 6 by 18 feet. These three rooms are *en suite*, as is the almost universal custom in American houses. The rooms are separated by sliding doors, which go back into hollow partitions, generally formed of two thicknesses of lime of teil blocks. Folding doors are almost unknown. The library has a spacious closet or store-cupboard. Behind the dining-room and on the same level is the butler's pantry. At the side of the dining-room, and leading from the private hall, is a stair down to the lower of the two storeys of the "duplex" in rear, the apartment on the other side of the hall owning the upper storey of the duplex. Behind the butler's pantry is the kitchen ; on the other side of the house is a servant's bedroom, at a higher level, over the butler's pantry of the other apartment ; and arranged round the central passage are three single bed-chambers of various sizes, and one large double one, all having spacious closets, a thing very noticeable to an English eye, accustomed frequently to none at all. The lighting is excellent—in fact, one could not wish for lighter rooms, and the method of obtaining this result is not unworthy of notice. The outer wall of the kitchen and butler's pantry opens upon a court or light-shaft, about 5 feet wide. The house here is narrower than at any other part, and unless it were so it would also be the darkest part. Behind this again the house widens-out, but still keeps much within the boundary-lines of the lot. At the back, moreover, the building is 5 feet within the back line of the lot, and has an iron balcony occupying the space ; this serves also as a fire-escape, by means of ladders from balcony to balcony, up and down. These fire-escapes (sometimes running right up the front of of houses in fairly good streets) are very common in American cities. It should be noticed also that just in rear

of the public staircase is another shaft, containing a servants' elevator, and adjoining this, and fed from it, are the coal-bunks. This shaft opens only upon the servants' department. The other floors of the building would be the same in character, though differing in detail perhaps. There are other points of interest about the building which it may be well to touch upon. Among these are the fittings in the sub-basement or cellar, such as pumps, &c. These fittings are four in number—two boilers and two pumps. One of the boilers works the two pumps and also makes steam for the steam-heating system; the other works the hot-water service for household purposes. Of the two pumps, one, a large one, works for the elevator only, and fills the tank at the top of the building. This tank stands on the flat roof, and is best compared to a vast cylindrical brewery vat; it affords the head of water required for working the hydraulic elevator, which is one of the well-known "Otis elevators" by Messrs. Otis Bros. (now merged into the American Elevator Company, I believe). The pump itself is not without interest, from an architect's point of view: It is, I think I may say, absolutely silent—at all events, one can hear a whisper while standing beside it as it works. I am told it is known as the Worthington Duplex Pump. The small pump fills the house-supply tanks or cisterns, and also the boilers on first starting. The water which these pumps raise is drawn direct from large iron tanks just alongside, standing on the floor of the cellar. These are filled by gravitation from the large Croton Reservoir which supplies New York City. The waste or discharge water from the elevator machinery is passed again through the pumps and re-used. One of the boilers, as mentioned before, supplies steam, which is conveyed by pipes to each room, and there heats the room by means of direct radiation from a coil of pipes, called a radiator, under the window or in other suitable positions; and each of the principal rooms, both reception and bed rooms, has a fireplace. The utmost economy of power is one of the great characteristics of these systems in America, and in this case the exhaust steam from the pump is repassed through the boiler by means of a kind of circulating-pipe, helping to heat it, and then at length discharges upon the roof. The general construction of the building is as regards the walls, brick with freestone dressings. The floors are not fireproof (so called), but simply wooden joists and ordinary flooring; generally the reception-rooms have parquet flooring of a very highly finished character, and often elaborate design, on rough under-floors, much as we have here in England. The walls are plastered, and the wood skirtings, doors and general finishings are very elaborate in detail and refined in feeling. The woods used are, as is always the case in America in buildings with any pretensions to careful finish, of great beauty and variety; but this question of the wood used in America for constructive and decorative purposes is worthy of a separate notice.

Entirely separated by party-walls from the last building described (namely, the Hubert Home Club), but forming part of the same block, is a building called the "Annexe-building," which is entered by a separate entrance-door, with its own public staircase. I have no plans of this, but it is with the arrangement and principle of its staircase that I wish particularly to deal. The principle is this: nine floors above the basement, each 9 feet high in clear, have a public staircase running right up through them. The top floor is let as studios, and has no other floor in connection with it. The first storey, or ground-floor apartment, has access from the street, and within itself a stairway leading up to the second storey and down to the basement, these three floors forming one apartment; the first storey being used as reception-rooms, &c., and the upper as bedrooms. The third and fourth, the fifth and sixth, the seventh and eighth floors are coupled in the same way. Entrance, however, can be had from the public stairway to the lower floor only of each apartment.

The Hubert Home Club, No. 7, an apartment-house on Twenty-eighth Street and Madison Avenue, in which also are the offices of Messrs. Hubert, Pirsson & Co., may, I think, be passed over without further remark than that, in general style and finish, it is very similar to the Fifty-ninth Street building before described (not the annexe building). The plan of one storey is given in Illustn. xxiii. It has fireproof floors and an iron public staircase, with tile treads bedded in flanged iron frames. The roof is covered with tiles in cement on two layers of asphaltic roofing cement, with four or five layers of roofing-felt between them, each layer being bedded in asphaltic cement.

The large block of apartment-houses known as the "Central Park Apartments" [Illustns. xxiv, xxv, figs. 70-77], which was in course of erection at the time of my visit to New York, will furnish some interesting particulars on the subject. It occupies a site, bounded on the west with a frontage of 201 feet, by Seventh Avenue; on the south by Fifty-eighth Street, with 425 feet frontage; on the east by adjoining property, and on the north by Fifty-ninth Street, which forms the south boundary of Central Park. The site is to be occupied by eight blocks of buildings, with a central court or series of courts. The longer axis of the site runs east and west, and is also the axis of the central court; and both north and south of this are arranged four blocks of buildings, each again being separated from the next by an archway for thorough ventilation to the central courts. At the point of intersection of these archways with the longer axis there are fountains and flower-beds, treated as a central feature. The result of this arrangement gives ample light and air to all the houses. The four corner

blocks have a frontage of 95 feet each to the street on which they abut, and depth of 85 feet—two of these latter dimensions being upon Seventh Avenue, and two upon the private road leading from Fifty-eighth Street, and intended to give access for carts, &c., to the cellar floor of the houses. In the courts are skylights for light and air to this lower court or tunnel. Thus the entrance-court is kept free from dust, noise and other nuisances, which are to a certain extent unavoidable, and the whole of this kept down below where the tradespeople deliver goods at the foot of the servants' elevators. The basement is divided, exclusive of janitors' rooms, passages, &c., into two portions, one of which belongs to each of the corresponding holdings on the floor above, thus making practically a two-storey house. The first storey, or ground floor as we should call it, is divided into two holdings as indicated. The second, fourth, sixth and eighth storeys have each a pair of holdings with offices, &c., in the duplex. The third, fifth and seventh storeys have one holding on each floor, making thirteen holdings or apartments in all. For choice of apartments the members, who are really members of a co-operative society, hold an auction, and the right of first choice is bid for by those members who hold a similar number of shares. The shares for each block are sixteen in number, and are held as follows : by each member requiring an apartment covering half a floor, one share ; by those requiring a whole floor, two shares—giving sixteen shares and thirteen holdings. The two-share men bid against their own species, and the one-share men against their's. The money from the auction is divided equally among the members, or retained by the company for the use and benefit of all, in paying for janitor, &c., &c. The situation of the buildings is one of the pleasantest in New York, as it has the advantage of proximity to, and overlooks the open space of, Central Park. The air here is probably the purest to be had by city residents, though the atmospheric condition of the whole of the residential parts, at least, of New York, is by no means to be despised. The locality is claimed to be one of the best drained and the highest south of Central Park. Access is easy, both up and down town, by the Elevated Railroad, and across town by the horse cars. Messrs. Hubert, Pirsson & Co. claim that, while securing by means of concerted action, good light and ventilation, easy services, a handsome building and economical construction, the building affords a series of eight blocks, in each of which thirteen families, suited socially to one another, can obtain a home of a permanent nature, and with full domestic privacy and comfort. The buildings are designed to meet the needs of those who, with a small family (or indeed a large one), find it impossible to procure houses in the ordinary way, which, though they furnish a sufficient number of reception rooms, give bedrooms far too numerous for their wants or do not give sufficient.

The method of financing and managing this large undertaking is similar to that of the Hubert Home Club. Of this system I hope to say something further on, and to describe its working. Unlike them, however, in this case the land is leasehold, and instead of a sinking fund to pay off a mortgage on the purchase of the freehold, ground-rent is paid, thus reducing the liability of individual members. The gardens or courts before mentioned are private, for the use of the inhabitants only; the tradespeople enter on the basement as stated above, and the only vehicular traffic is that of the carriages of occupants. Drying-room, for laundry purposes, or a space on the roof can be had as may be preferred. In each block (containing thirteen holdings) three holdings occupy a whole storey, and cover an area of 7,800 feet super. The remaining ten cover each 4,700 feet super., being one half of the frontage and floor space of the front of the building, together with the equivalent of the whole of the floor area of the rear portion, but this is of a less height, and duplexed with the adjoining holding on the same floor, as explained in speaking of the Hubert Home Club on West Fifty-ninth Street. A comparison kindly procured for me by Mr. Hubert, between one of these apartments of the smaller type and some recent New York houses of the ordinary type, shows the advantage to be considerably in favour of the apartment. The mere difference in superficial space in the rooms, omitting stairs and passages, is 151 feet super. In the house, the parlour floor has 741 feet super—the basement dining room not counted, as it cannot be used *en suite*. In the apartment four sitting or reception rooms give 1,483 feet super, all *en suite*, double the space of the house quoted, being one-third more than a house 25 feet by 60 would give, and equal to that of a house of 30 feet frontage. The four flights of stairs, and the amount of domestic service involved in the house, are minimized in the apartment, and the administration and service are proportionately easy. The apartment is easily taken care of by the janitor during absence. Combination allows of easy and cheap steam-heating, hot water supply, fireproof construction, and safety from thieves. To complete the picture, house rent is one-third less than that paid for a private house. The annual expense for a single apartment is estimated at 1,312 dollars, and for a double one 2,624 dollars.

The construction of the buildings is worthy of notice, as they are entirely fireproofed, the floors being rolled-iron joists, with brick arches ; the partitions fireproof, mostly of lime of teil blocks ; and the roof of brick in cement on asphalted felt, carried upon iron beams. The stairs are of iron, with tile treads. The plumbing, as is naturally the case under the New York law, is of the best quality and well arranged—rising lines are

carried-up in special ventilating shafts, and all sanitary arrangements kept near the latter. The interior finish is to be simple, but judging from the other works of the kind now in progress under these architects, of elegant detail and fine woods. Owners can have their apartments finished and decorated to suit their tastes, or the internal plan modified during building, so long as the main structure be not interfered-with. Steam-heating and boiling water are supplied to each apartment. Both artesian well and Croton supply are provided. Two passenger elevators—one in rear for servants or tradesmen, and one in front for visitors and occupants—not surrounded by the stairs, as the latter arrangement rather damages the lighting of the central hall. Gas is laid on, and provision for electric lighting by incandescent lamps is made.

A few particulars of the way in which some of the apartment-houses of New York have been put in operation may not be uninteresting. The Dakota, the Vancorlear and the Wyoming, have, I think I am correct in saying, been the speculation of either a private individual, or at most an association of individuals without necessarily any personal interest in the occupants beyond their position as landlord and tenant—the landlord perhaps not even residing in the house. But those under Messrs. Hubert, Pirsson and Co. are on an entirely different principle, which has been elaborated by themselves, and was originated by Mr. Hubert. While the former arrangement is one quite usually and thoroughly understood, the latter is of a kind which appears to have had at first some difficulties, and mystery even for New York lawyers. It is now, however, in successful operation, and has the confidence and approval both of the legal and commercial mind. The idea is briefly this :—A Home Club or co-operative building, in which each of several heads of families by previous agreement arranges each to own and occupy his own rooms. This gives the opportunity beforehand for each member to choose his associates in the affair, and it allows each to form an opinion of the desirability of his neighbours, thus avoiding the chance of the proximity of undesirable persons or families under the same roof. At the outset grave theoretical difficulties came to the minds of the originators, but with legal help these were got over, and the project fairly thought out. It was some time, however, before the idea recommended itself to the class for whom it was especially intended, viz., the New York householders, and longer still before the doubts in the minds of their legal advisers could be overcome. Eventually all the members of the first proposed Home Club were able to give their adhesion to the scheme, which was practically the individualizing of the share of ownership of each member by the grant of long leases at a nominal rent. Of course there is nothing difficult or impossible in five or ten men each paying a one-fifth or a one-tenth share in the expense of erecting a building of which he is, when it is finished, to occupy a proportionate share; but in the case of death, insolvency or wish to dispose of this one-fifth or one-tenth part, endless complications might arise. Here the legal mind intervened to help them out of their difficulties, which might have involved costly litigation, by arranging the whole matter so that they had a fair legal basis to go upon, and a certainty, as far as human certainty can go, that they could tide over any of the dangers above mentioned. The property was vested in the Club or Association composed of all the members, and is held by it as a corporate body, which leases to each member his own apartment for ninety-nine years. This lease (like any lease of an ordinary kind) is marketable property, and can be sold (as a matter of fact, these leases have been sold again and again). The arrangement makes the investment of the building-fund money a safe one, and one for which there is quite as much certainty of finding a sale, as the lease of an ordinary house. Again, should an owner elect to sell his share, there would be the chance of his selling to some person objectionable to the other occupants of the Club, were it not that each lease has a clause providing that only a person approved by a certain majority of members (provided in the rules) can be the purchaser of the lease. And should a legal or forced sale be necessary, the members would have the chance of purchasing the share and binding any new member to the same rules, &c., provided in the lease. Should also one of the occupants become objectionable to the others, or a majority of them, he, being bound by the terms of the lease, would be subject to expulsion. This kind of thing, however, would be necessarily of rare occurrence, seeing that in the first instance the original members would be probably all well known to one another, and afterwards would be subject to the approval of the majority. I have mentioned the way in which the less desirable apartments are disposed of, viz. : by sale at auction of the right to choice of rooms. The janitor may be provided, paid and supervized by the members in rotation, or by an agent appointed for the purpose, who will give an account of his agency. The expenses of this are equally divided, and form a kind of tax which the members are bound to pay by the terms of their lease. The same may be said of the charges for cost and supervizion of the repairs, warming and lighting of public halls, &c., and it is these matters, and these alone, which are the common property and responsibility of the members. The dwellings or apartments have their own entrance doors, and cannot (once inside) be any more accessible than an ordinary house. The finances and all rules of each club are quite distinct, and managed by its own officers, so that each building and all its affairs are under the control of the proprietors, and are

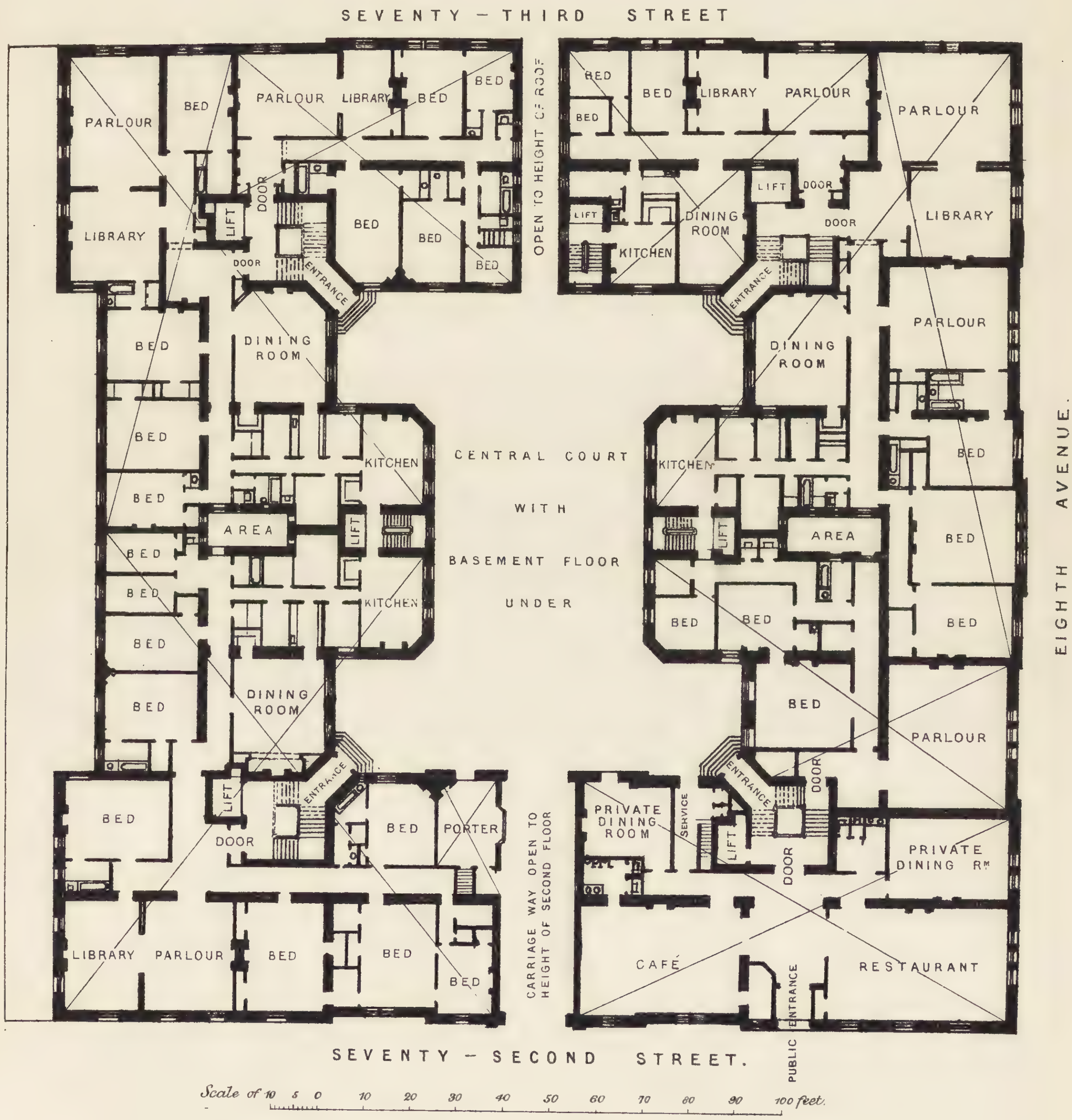
in no way connected with those of any other. The cost of each of the four corner blocks of the Central Park Apartments is put down at 280,000 dollars; the rest cost 240,000 dollars each. Taking one of the latter, 160,000 has to be raised among the associates, being 10,000 each for a single share and single apartment, or 20,000 for double share and double apartment. The balance has been raised on mortgage, and a sinking-fund of three per cent has been arranged; ground-rent, interest on mortgage, taxes, sinking-fund, and running or working expenses make up the yearly expense, amounting to 1,312 dollars per single share per annum. As to the annual expense of such apartments compared with the rental of holdings in similar apartment-houses in the same locality, I may again quote Messrs. Hubert, Pirsson and Co.'s figures:—

A landlord	receives	2,000	dollars for	11	rooms	covering	1,718	square feet
„	„	2,000	„	9	„	„	1,509	„
„	„	1,500	„	9	„	„	1,144	„
„	„	1,200	„	10	„	„	1,321	„
„	„	1,200	„	10	„	„	1,301	„
„	„	1,400	„	11	„	„	1,618	„
One of the Home Clubs	received	833	„	12	„	„	1,819	„

To this it would be fair to add some 60 dollars annually for interest on outlay of, say, 1,000 dollars for grates, mirrors and gas-fittings, which have to be done by each individual, the landlords of the houses quoted providing these ready in position.

A few words should be added as to the sanitary legislation under which these apartment-houses and other buildings are erected. The drainage question generally and house drainage particularly are engrossing and have done so for some time the attention of Americans. In many cities there are specialists working assiduously and with marked success to better the sanitary condition of the houses of the masses, as well as of the more wealthy classes. There is in most cities now a plumbing law, which lays down precisely and clearly the conditions upon which plumbing and house drainage are to be carried-out, and without attempting a complete list I may refer to the plumbing laws of New York and Washington, D. C., and the work done by Colonel Waring of Newport, R. I., in many parts of the country as evidence of the attention given to the subject. In the two cities of New York and Brooklyn there is a stringent plumbing law entitled "An Act to secure the Registration of Plumbers, and the supervision of Plumbing and Drainage in the cities of New York and Brooklyn." This Act was passed in June 1881, and provides that all plumbers shall register their names, &c., at the Health Department of the city—that a list of such plumbers shall be published at least annually—that the Board of Health shall examine and approve all plans and specifications for plumbing, and register the same—that a money grant shall be made for carrying-out the Act—that certain Courts shall have power to compel obedience to the Act, &c. Then follow, in three clauses, rules and regulations as to the following:—1. The method of plumbers' registration; 2. The forms to be gone through in order to obtain approval of proposed works; 3. The detailed statements of the system of plumbing to be followed with methods of construction, materials, &c., &c. As in the case of apartment-houses and tenements also, previously referred-to, which are under the control of the Board of Health, a very complete system is in operation, by which the machinery of approval of plans—supervizion during progress—prosecution in case of violation—are all kept working easily and effectually. One thing I must not omit to mention, namely, that an outline specification provided by the Board is required to be filled-up (as required for the circumstances of each case) by the applicant, and this greatly facilitates easy examination and makes it clear to all applicants what will be expected of them. I can hardly in the present Paper say much about the method of working adopted by the Board in conducting what has been really a vast scheme of reform, but I gathered from external as well as internal evidence, that there must be a large amount of good plumbing and drainage now in hand, some of which would, if left alone, be of the vilest description. One point, which has its humorous side, I may mention to illustrate the thoroughness of the arrangements made. Plumbers who do not believe in the first principles of the action of water, &c., in traps and pipes, and who are unwilling consequently to amend their ways, are taken to a room in the Board of Health offices, and there shown the working of a series of glass traps, pipes, &c., illustrating ordinary sanitary appliances, and the effect of syphonage and improper trapping is explained and proved by actual experiment. They are said to need no more proof, and to be rendered docile and obedient to plumbing regulations by one visit.

V. THE GODWIN BURSARY: TOUR IN THE UNITED STATES OF AMERICA (xxi).



THE DAKOTA APARTMENT-HOUSE, NEW YORK.

FIG. 65, GROUND FLOOR PLAN.

C. F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

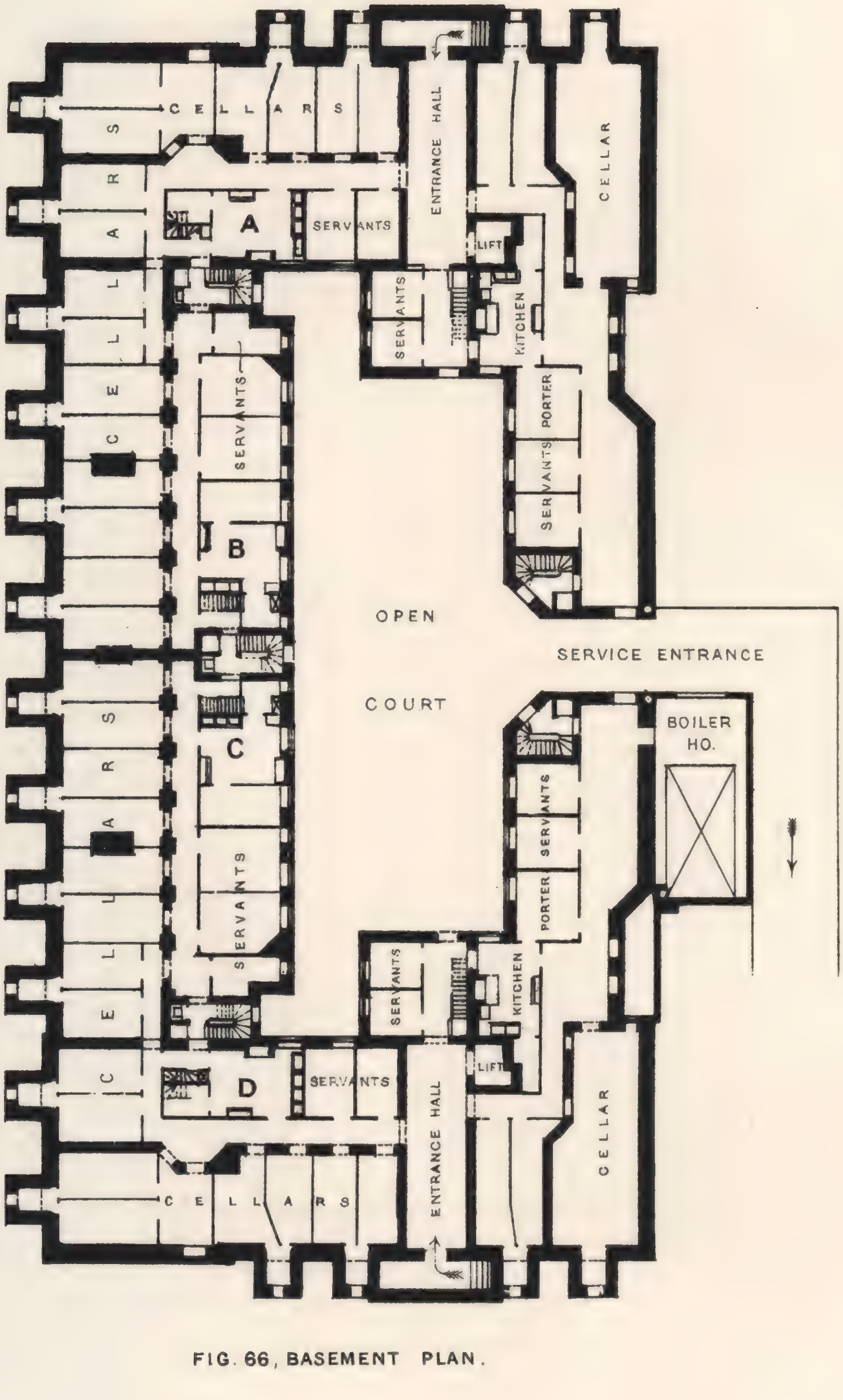


FIG. 66, BASEMENT PLAN.

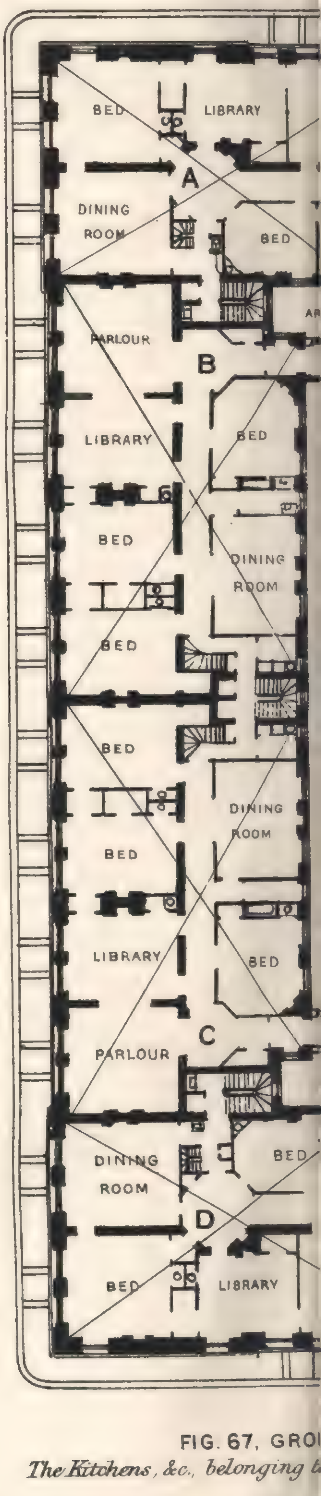


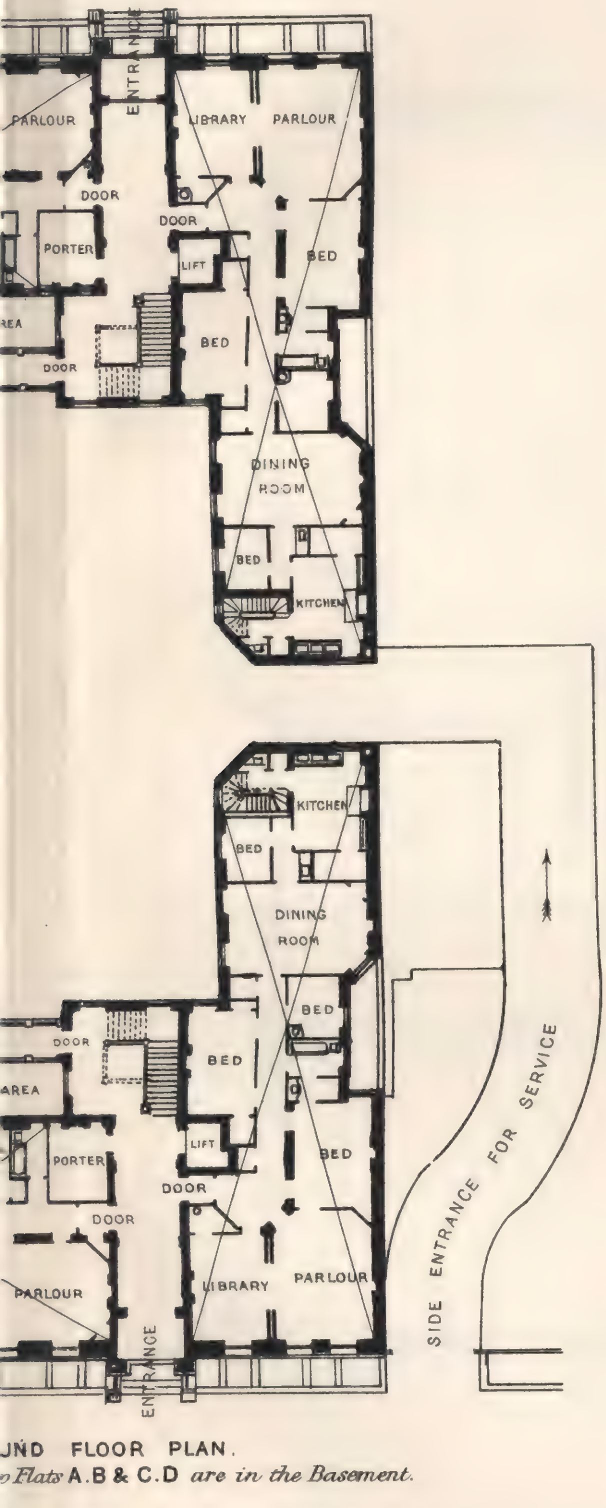
FIG. 67, GRO

The Kitchens, &c., belonging t

THE VANCORLEAR APA

SCALE OF 10 0 10 20 30

N THE UNITED STATES OF AMERICA (xxii).



UND FLOOR PLAN.

o Flats A.B & C.D *are in the Basement.*

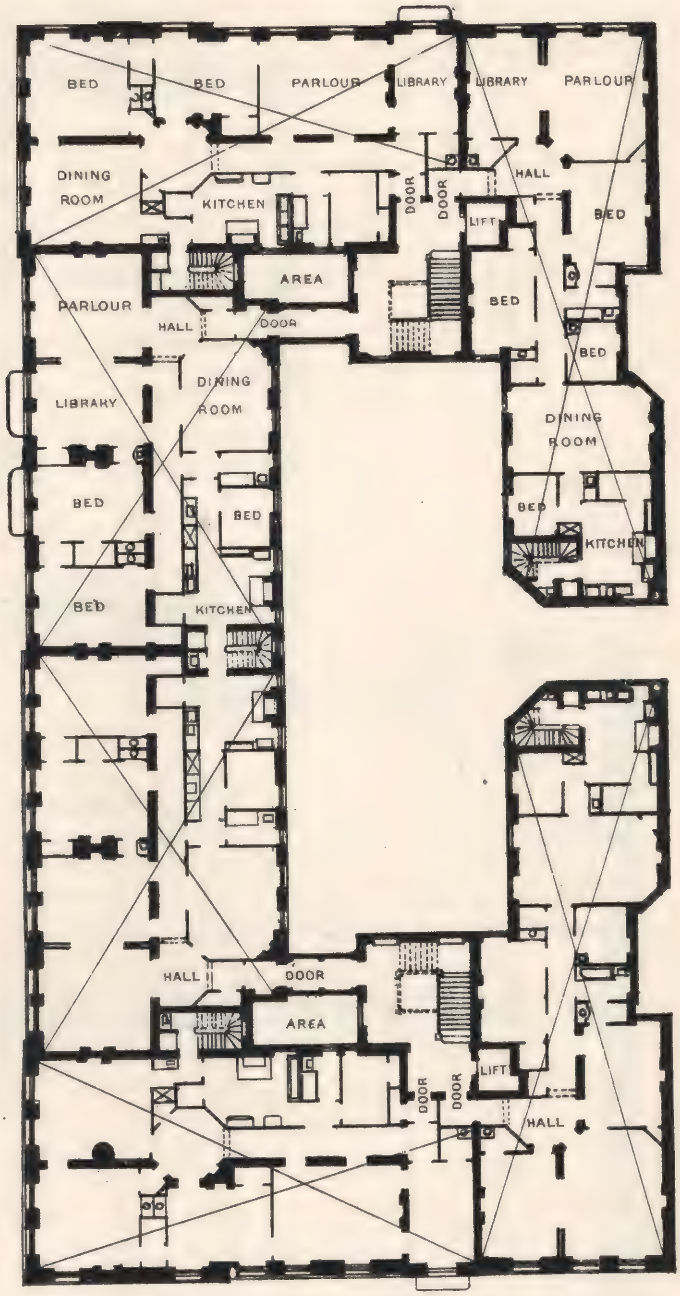


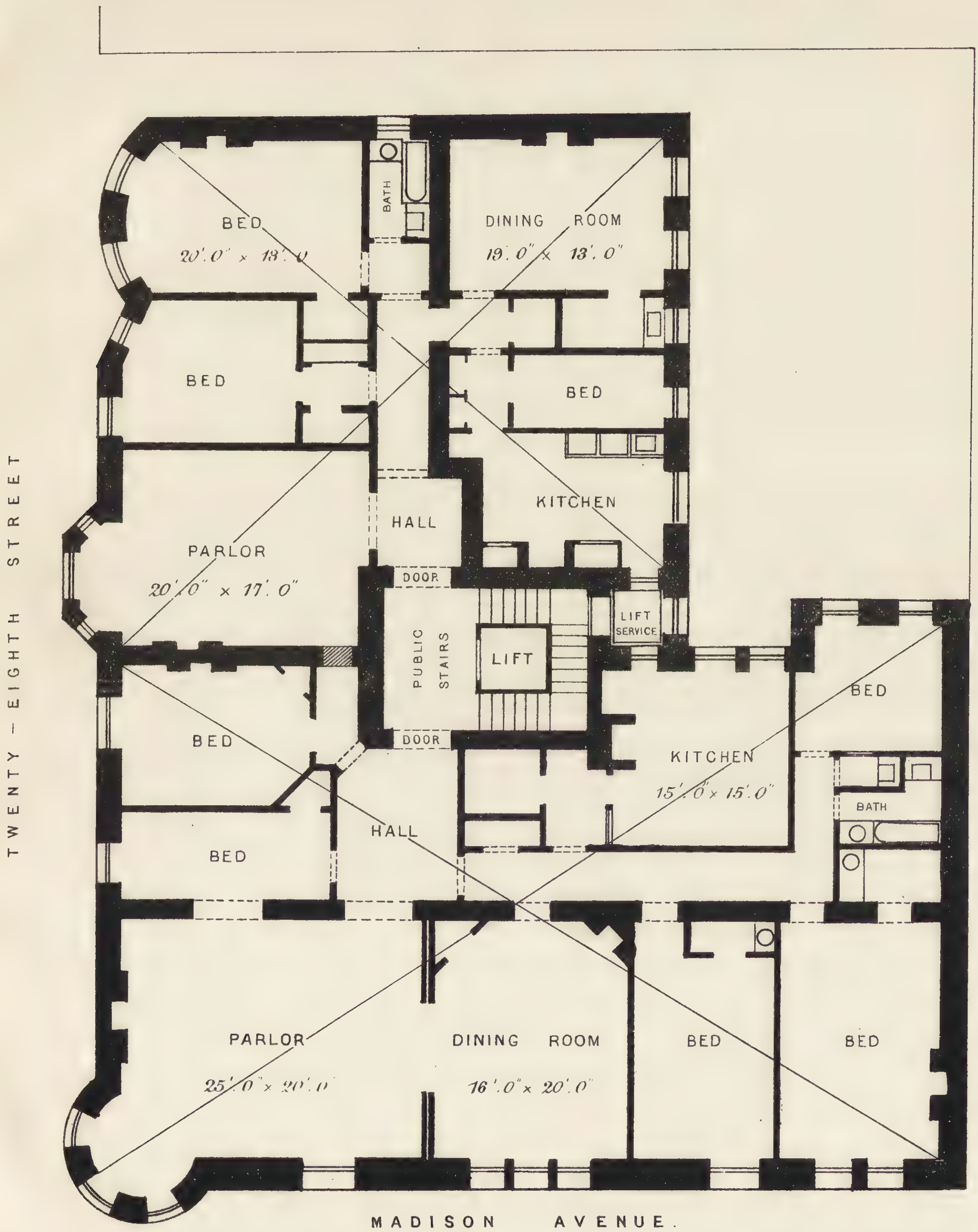
FIG. 68. PLAN OF UPPER STOREYS.

ARTMENT-HOUSE, NEW YORK.

40 50 60 70 80 90 FEET

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

V. THE GODWIN BURSARY: TOUR IN THE UNITED STATES OF AMERICA (xxiii).



THE HUBERT HOME CLUB, NEW YORK.

FIG. 69, PLAN OF UPPER STOREYS.

V. THE GODWIN BURSARY: TOUR IN THE UNITED STATES OF AMERICA (xxiv).

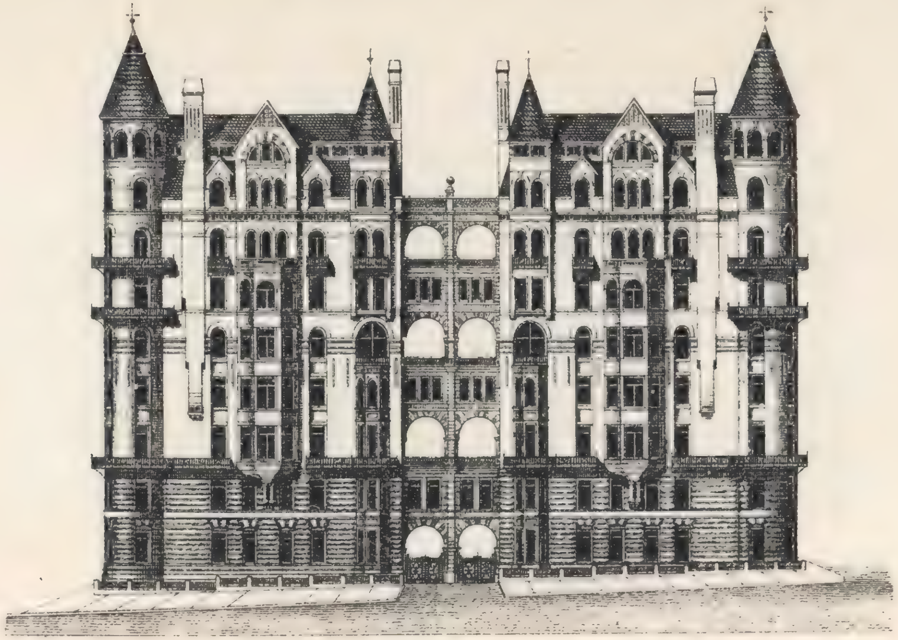


FIG. 71, 7TH AVENUE ELEVATION OF BUILDINGS.

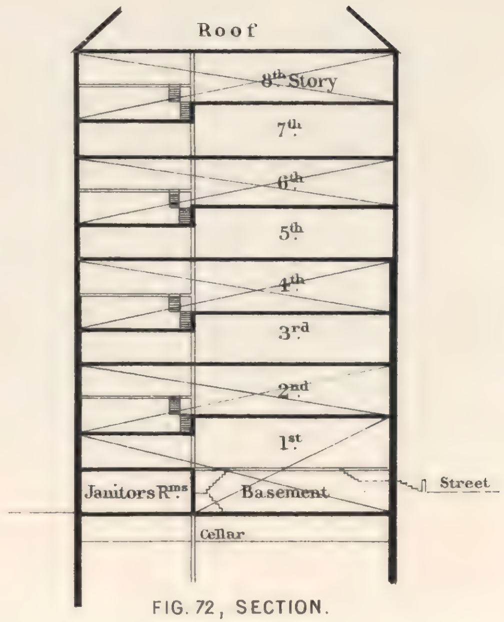
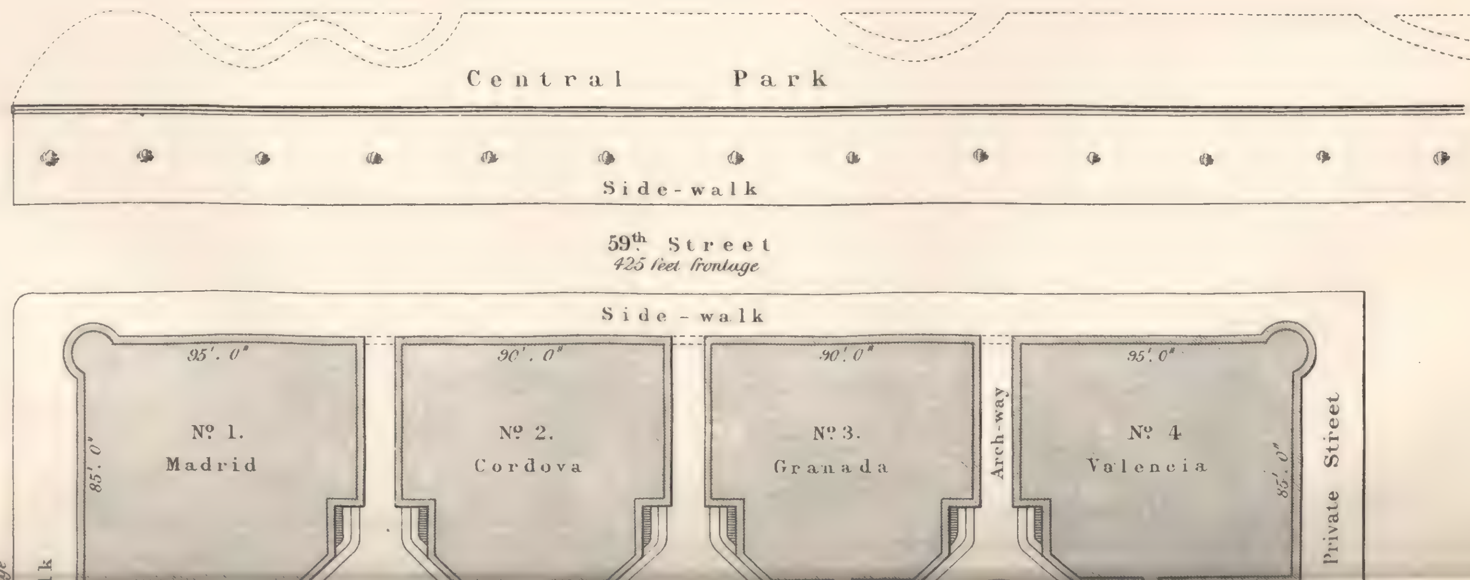
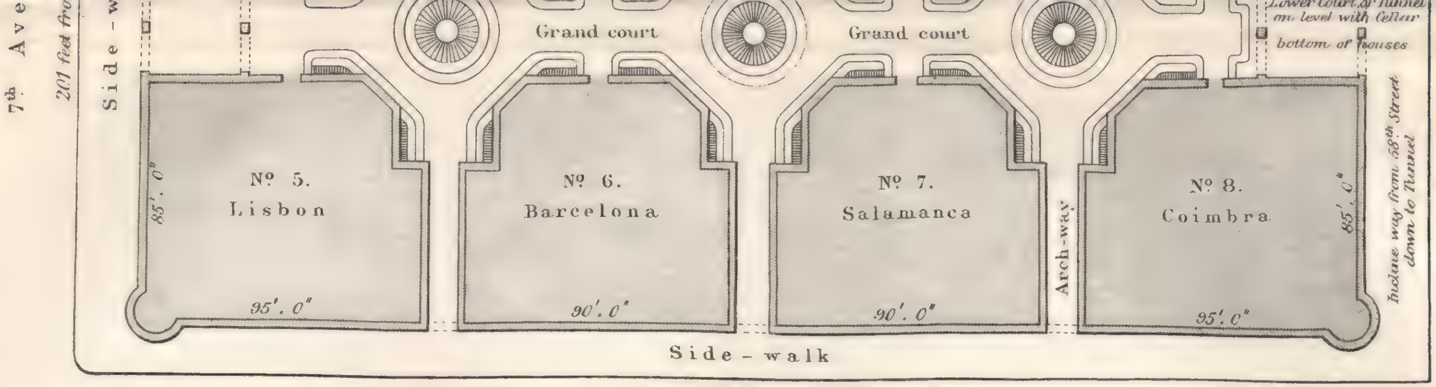


FIG. 72, SECTION.





58th Street
425 feet frontage.

FIG. 70, GENERAL PLAN.

THE CENTRAL PARK APARTMENT-HOUSES, NEW YORK.

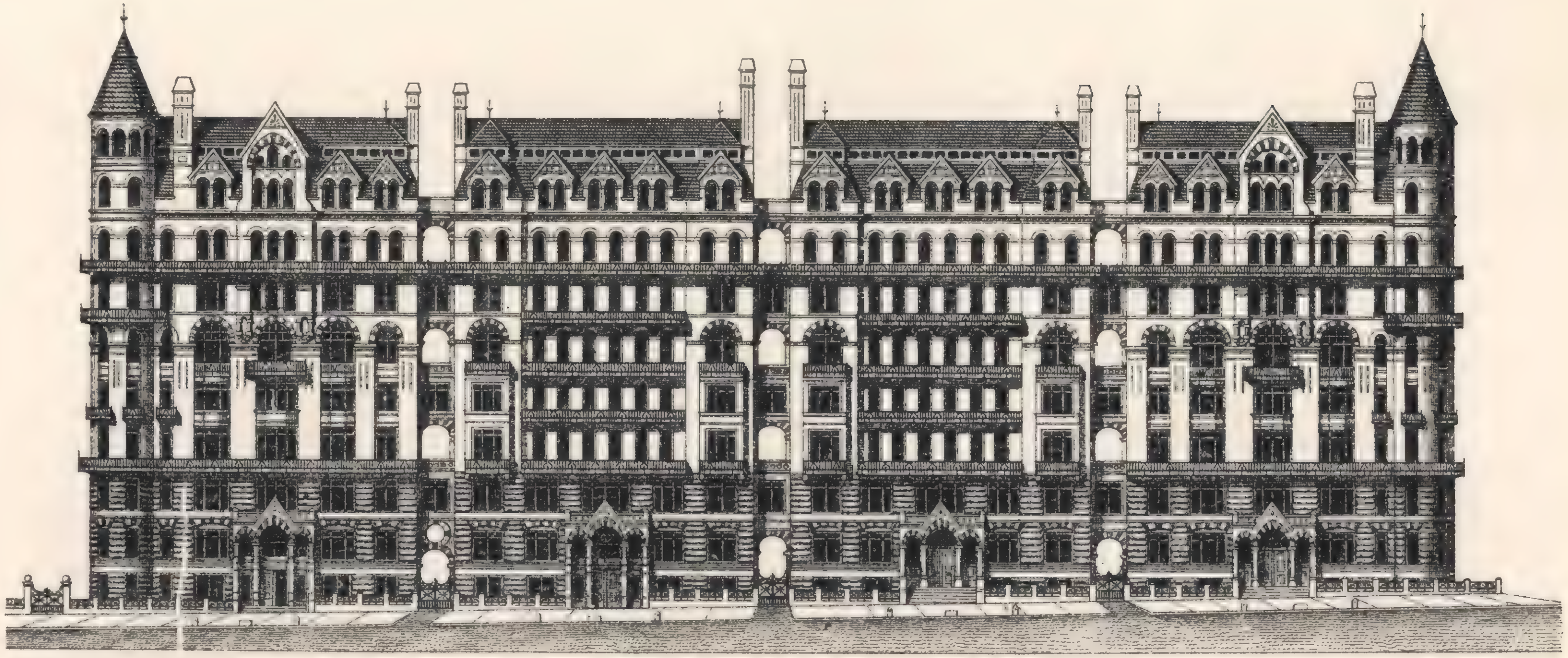
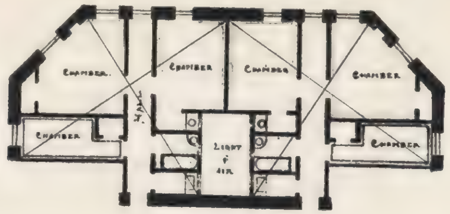


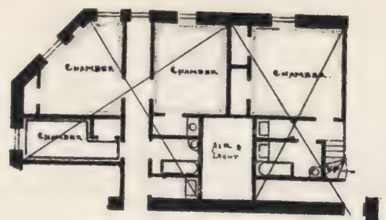
FIG. 73, 58TH & 59TH STREET ELEVATION OF BUILDINGS.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

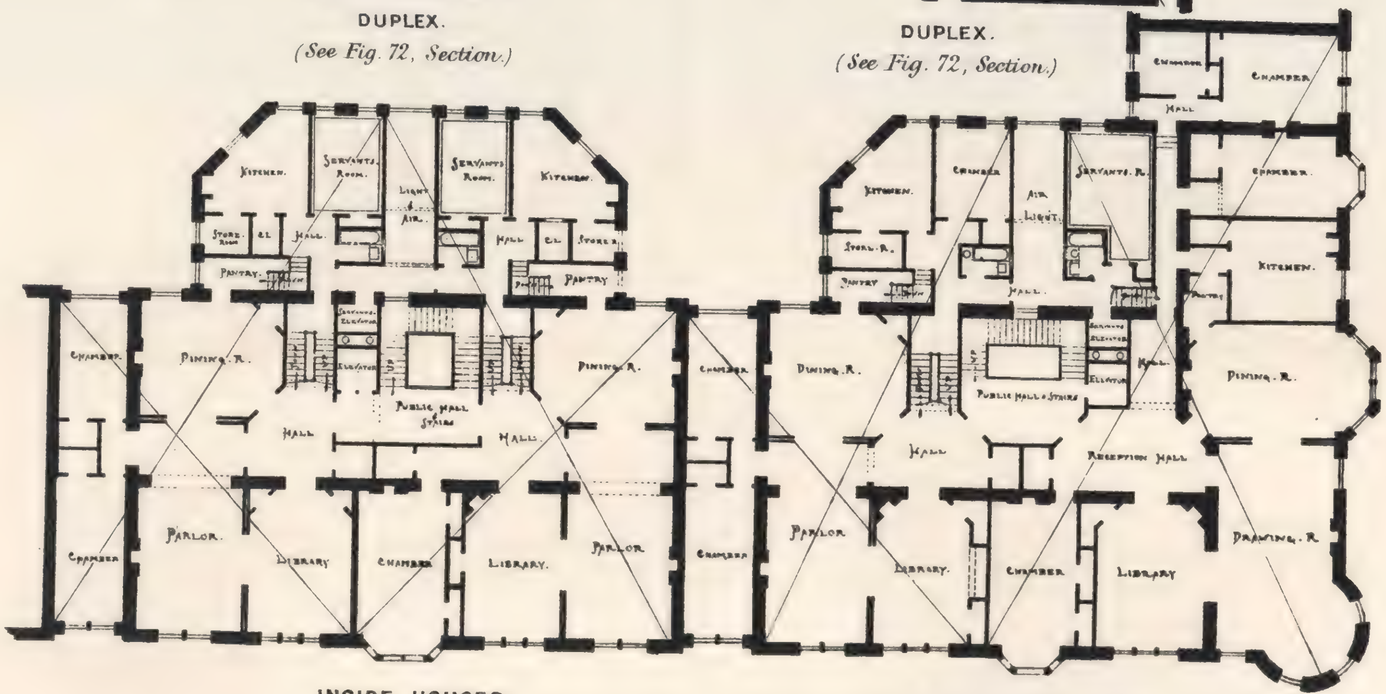
V. THE CODWIN BURSARY: TOUR IN THE UNITED STATES OF AMERICA (XXV).



DUPLEX.
(*See Fig. 72, Section.*)



DUPLEX.
(*See Fig. 72, Section.*)

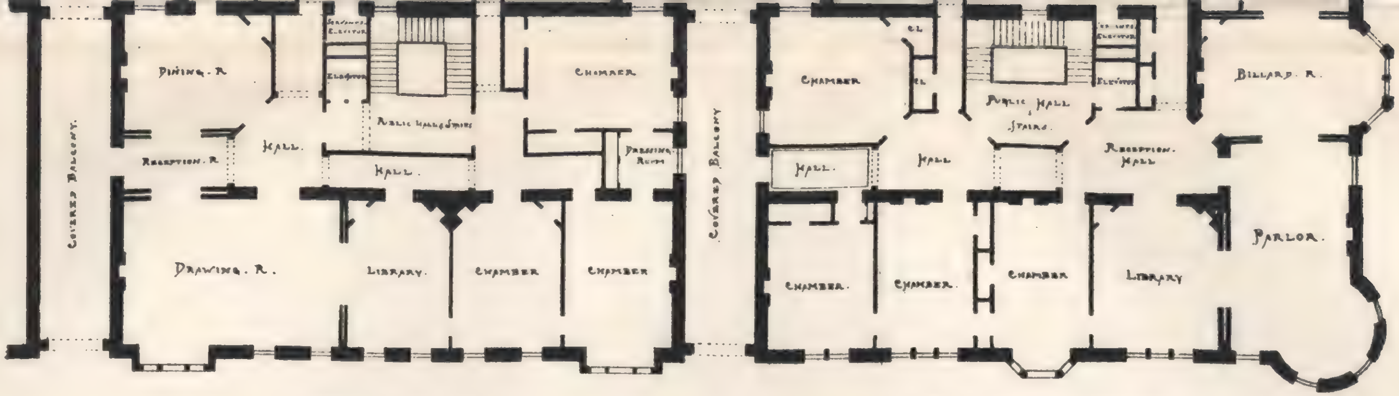


INSIDE HOUSES.

N.W. CORNER HOUSE.

FIG. 74, SECOND, FOURTH, SIXTH AND EIGHTH STOREYS.
(*Two Flats on each Storey*)

SCALE OF 10 0 10 20 30 40 50 60 70 80 90 FEET



INSIDE HOUSES.

N.W. CORNER HOUSE.

FIG. 75, THIRD, FIFTH AND SEVENTH STOREYS.

(One Flat on each Storey.)

THE CENTRAL PARK APARTMENT-HOUSES, NEW YORK.

NORTH WEST CORNER HOUSE.

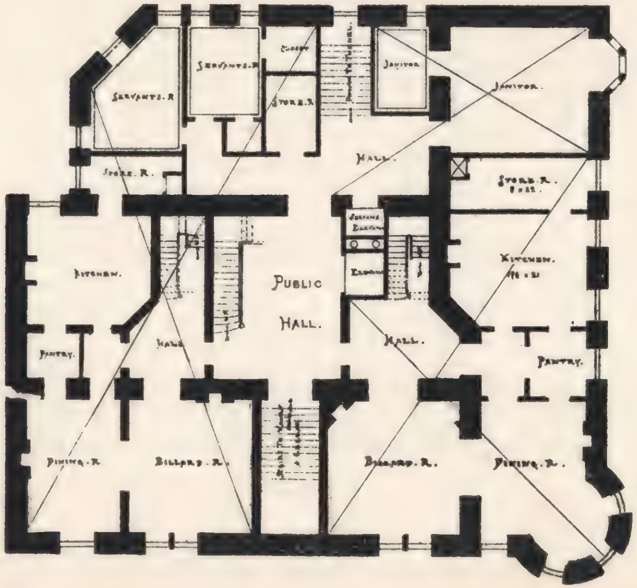


FIG. 76, BASEMENT PLAN.

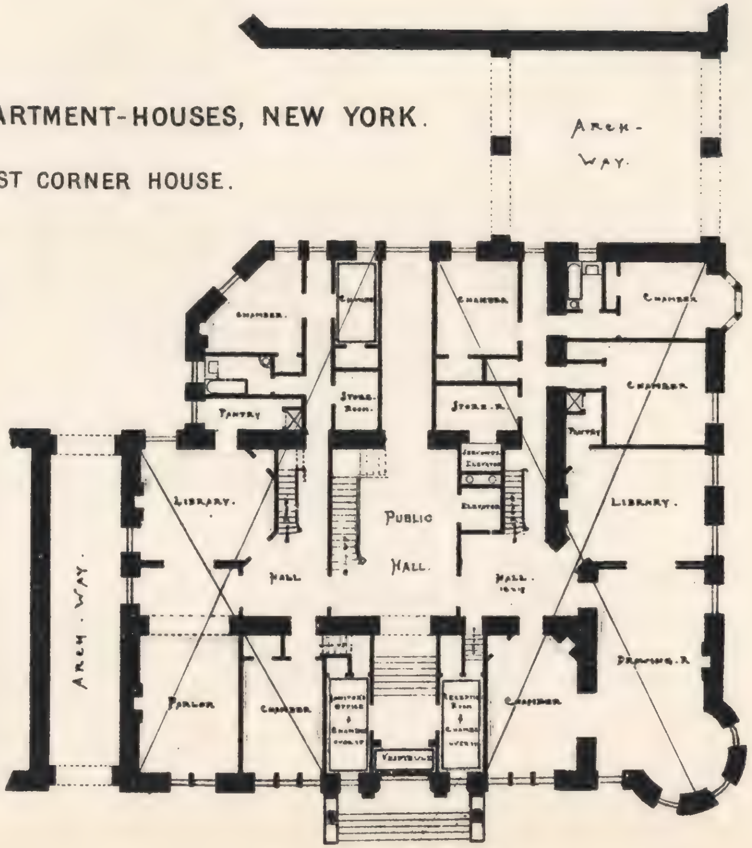


FIG. 77, GROUND FLOOR PLAN.

VI. ARCHITECTURE IN THE HIMALAYAS.*

By William Simpson, F.R.G.S., *Hon. Associate.*

[Read on Monday, 22nd January 1883, Horace Jones, *President*, in the Chair.]

THE word Himalayas expresses a large geographical space, which on the south-east touches China and Burma, while on the north-west the Hindu Koosh reaches into Central Asia. Much of this space is very little known; some of it has never been explored; and, with the exception of Kashmir, almost nothing has as yet been done with regard to the architecture of this wide field. The Paper which I propose to read will touch only upon a limited portion of the ground: it will deal principally with the style of building in the Sutlej valley, and the region to the south-east as far as the valleys of the Jumna and Ganges, to which I will be able to add some details of Thibetan architecture from the Indus valley. What I have got to lay before you is rather fragmentary, but it may be of some practical interest to the architect, and it may also be of slight value from its bearing on the origin of the forms of Indian architecture. Among the few details of Thibetan construction there is one which I think important, as illustrating a point connected with the Buddhist architecture of the Jellalabad valley, a subject upon which I have had the honour of reading a Paper.†

It is over twenty years since I visited the Himalayas, and I regret that this Paper was not written when everything was fresher in my memory, for now I find there are points on which I have to speak with some uncertainty; and it may also be mentioned that architecture was not the primary object of my visit. I was seeking the splendid scenery of the Himalayas, where, as I spent two summers—each extending about six months—I made a considerable number of sketches, and as these in many cases included temples and houses, I am able to give with this Paper copies of some of them; and the numerous sketches I made have been carefully enough done to supply me with sufficiently authentic material for this Paper. The first summer, that of 1860, was spent at Simla, and included a trip, which lasted three months, to Chini, about 200 miles to the east of Simla, on the Sutlej. The next summer I started from Mussoorie, and travelled along the Ganges to its source at Gangootree. Returning from that, I crossed over to the Jumna valley, and visited the source of that river. From that I went over the Roopin Pass, 15,000 feet high, to the Sutlej valley, and crossed the river near to Chini, and then went on into Thibet by the Spiti valley, and the Purung Law, which is 19,000 feet above the level of the sea [Illustn. xxvi.] In this region I was among a Buddhist population, where monasteries were plentiful, and I was able to watch the peculiar rites which were performed in them by the monks. From the Indus I returned by Kashmir, and on coming back to England in 1862 I read to this Society a Paper‡ which gave some description of the architecture of the last-named locality.

I would say that in all probability the architecture of the Himalayas was originally wholly of wood. Extensive forests, which still exist, of the *Cedrus Deodara*, a wood of great durability, might in itself explain the supposition, but it is at the same time supported

* Mr. Fergusson devotes a portion of his *History of Indian and Eastern Architecture* to this subject (see Book III. Architecture in the Himalayas, pp. 279-318).

† See the Transactions, 1879-80, pp. 37-64.

‡ See the Transactions, 1861-62, pp. 165-178.

by what we know of the early architecture of the plains of India, which at one period was of wooden construction. In those parts of the Himalayas which I visited, stone is also used in combination with wood, and stone being also easily procured in a hill country, the use of this material may be assumed as not of a late date. As none of the structures were of any antiquity, there was no possibility of finding dates in the past for any of their peculiarities. The simpler structures, such as outhouses, were formed wholly of wood; beams were mortised, or rudely dove-tailed together, and flat boards filled up the sides. The workmen seemed to have no tools except a kind of adze with a short handle, and with this all the parts of a building were fitted.

In the region from the Sutlej to the Ganges valley, the most of the better class of houses, and even very poor ones, were built with stone and wood; wood, being plentiful, was thus made to do duty for lime, reminding us of the old English use of wood and brick. In the Himalayas the wood is always laid in a horizontal position, and never perpendicular or diagonal, as in the English examples. In the well-built houses the wood is very carefully arranged, the beams being perhaps about a foot or so in depth, extending the whole length of the wall—a beam on the outside and another on the inside, the space between being filled-up with stone. The wall at right angles has its beams laid on the two just mentioned; on these again rest the next set of beams of the first-mentioned wall, and thus they go on alternately. In one house I saw building, the ends of these beams were slightly let in to each other [Illustn. xxvii, fig. 79], and in addition to this small pieces of wood were dove-tailed in between each of the two beams to prevent them from bulging out by the pressure of the stones. From this it will be understood that this mass of woodwork is capable of holding together itself, without the stones, which are filled-in between to make it a solid wall [fig. 80]. On the top of this mingling of wood and stone stands the real dwelling, which is altogether of wood. By means of beams, it overhangs the more solid structure beneath. The Bussahir Rajah's Palace [Illustn. xxviii] at Serahn, which is rather an elaborate piece of building for that part of the world, shows the main features of this style of construction. The woodwork is a mass of frames filled-up with planks, such as the simpler buildings are already described; but in this case the projecting timbers are carried out into something like horns, or gurgoyles, and from the upper cornice, like a fringe, hangs a row of small pieces of wood. These are generally turned in a lathe, and they hang loose; the bells at the corners also hang loose, and are moved by the wind. Verandahs are common in this upper storey, and the Palace at Serahn has doors leading out to them, which are evidently copied from forms which are to be found in the North-West of India; the doorway in front of the lower storey, with its imitation of Hindu temples on each side, is also an importation from the plains. The roofs in this palace are all pointed. In some villages the roofs are pointed, while in others again they are all flat. The flat roofs are of course formed of wood; but in that part of the Himalayas which comes under the monsoon a flat roof would be a most uncomfortable arrangement, were it not that there is a birch-tree whose bark can be rolled off in sheets, which are perfectly waterproof, and a layer or two of them is laid on the roof, and then a slight covering of earth or mud, which is smoothed into a floor, on which fruit and grain are laid out to dry. The gable line of the pointed roof is not straight; there is an angle, and sometimes there are two angles in it, producing a steepness towards the ridge, and flatness on the lower portions towards the eaves. Many of these roofs are

slated, but the original form is undoubtedly of wood, many of the structures being still of that material; the number of angles depends on the rows of planks forming it, each row of planks being raised slightly to give a greater drip. It may be noted that this gives a Chinese look to these Himalayan houses; the turned-up line of Chinese roofs is popularly understood as being copied from a tent. It would be rash to take it for granted that the Chinese roofs are derived from the Himalayan ones, or the Himalayan from the Chinese; but we have here at least a much more reasonable process of development, which may have also been gone through in China, than that of the very doubtful tent theory.

The Devi-ka-makan,* near Simla [Illustn. xxix, fig. 82], is a good specimen of this style of building. It shows that temples as well as palaces were built with an eye to defence. The strong construction of the lower part of these houses was evidently meant to withstand an attack in troublous times. The Himalayas were not exempt from wars, and, so far as I saw, none of the villages were fortified. A man with property had to make his house his castle. A wooden house could be easily battered-in or burnt, and hence the use of stone in the lower parts of the principal dwellings. Windows in the lower portion, when they occur, are always small—not larger than a man's head. The doors were also small, and, as far as I recollect, they were not the usual approach to the house, the ordinary entrance being by a ladder made of a thick plank with notches in it, which afforded a passage to one of the verandahs, and, in case of an attack, the ladder could be pulled up, and the house thus isolated. To the present day, the cattle are kept in these lower parts, and, as many of them are high enough for one or more floors, an ample space for keeping grain is also provided.

A comparison of the Palace at Serahn and the Devi-ka-makan near Simla with plates 33, 34 and 35 of Fergusson's *Tree and Serpent Worhip*, will perhaps be of some interest to those who study the ancient architecture of India. These [Illustn. xxx, figs. 84-87] represent the sculptures on the gateway of the Sanchi tope in Central India, and the buildings on them show the kind of houses which existed in India at the time of Asoka, B.C. 250. The palace at Serahn existed in 1860, and most probably is still standing. Although some of the details differ, yet the points of resemblance between the buildings of these two periods present some remarkable coincidences. In both cases you will find a lower storey of considerable height, both with very small windows, and very few of them. The resemblance here is very striking. The lower parts of these houses of the Asoka period may have been built of stone, but I should be inclined to suppose they were generally of *cucha*, or sun-dried brick, for there is no indication of wooden structure in the representations of them. According to General Cunningham they were for the cattle, thus serving the same purpose as the Himalayan examples.† Above this storey comes the part which, it is evident from the sculptures, the people used as their dwelling; it overhangs the lower part, and is wholly of wooden construction. In general resemblance this upper storey is very like the Himalayan example, but when we compare

* "Devi-ka-makan" means *place of the goddess; devi* is feminine, and as all the temples seemed to be called "devi-ka-makans," it would imply that they were all dedicated to Kali; this point I do not feel sure of; in the case of a temple dedicated to Siva, it should be *deva* instead of devi.—W. S.

† "There are two or three storeys, the lowest of which is invariably used for cattle, and, when there are three, the second for grain; and the third, occupied by the family, is surrounded by a covered gallery, in which its inhabitants are generally seen sitting when at leisure." (*Lloyd*, Vol. I. p. 170.) Lloyd and Gerard visited the Sutlej valley as far back as 1821, and the account of their journeys is published in two volumes, 1840.—W. S.

the details, there is considerable difference in the forms; the most marked being the circular roof, instead of the pointed. While recognizing these details which are dissimilar, still we have in these Himalayan houses the nearest approach, among the styles of building to be found in India at present, to that practised in the time of Asoka. In the Dravidian architecture of Southern India, the most of the details can be traced back to the old Buddhist period, but not only has the style been changed, but the construction is altogether different; the general result has no resemblance. There is every reason to suppose that from Cape Comorin to the Indus, and most probably beyond that river, the houses, two thousand years ago, were all constructed very like what we see represented in the sculptures at Sanchi and other places. This mode of erection has long ceased to be practised, and the houses which are now to be seen have no resemblance to those of the past. The Himalayas have not been so liable to the effects of war and conquest as the plains, and this enables us to understand why so many things have remained there unchanged, the architecture being one, for it has retained forms which have suffered but little modification for the last two thousand years.

The circular wooden roof of the Asoka date was formed of ribs and planks laid over them, in somewhat the same manner as a ship is constructed. By supposing the bow and stern of a ship cut off, and the remaining portion inverted over a house, you will have a very fair notion of these peculiar roofs, which, except in the Himalayas, seem to have been used over the greater part of India. Such a roof is not what men working with straight cut pieces of timber would be likely to produce, at least anyone would not think so, yet we have no means of guessing what led to such a form being adopted; no doubt but there was a reason of some kind, and it would be a valuable point gained in relation to the architecture of India if an explanation could be found. These pointed, straight-sloping, roofs of the Himalayas have thus an interest, if they are as I suppose quite as old as the others, as showing a different manner of construction existing at the same time, and that the one was peculiar to the plains, while the other was in use only in the hills. What led to this geographical separation of the two forms is a subject I would like to see cleared-up,—but at present I can offer no explanation. As the straight-lined roof is the most natural one to produce with timber, I would be inclined to think that it is perhaps the oldest form of the two. That it is old, I think we have evidence in the fact that roofs have been developed from it, such as we find in Nepal and in Kashmir. The Nepalese temples have a number of roofs placed over each other, reminding one of a Chinese pagoda. As the roofs of the pagoda have their origin in the Buddhist *chatta*, or umbrella, the roofs in the Nepalese temples may have been repeated from a similar motive when Buddhism existed in that country. The Nepalese roofs have a projecting bracket under them, of which I saw no vestige in the parts of the hills in which I travelled. These brackets remind me of the wooden street architecture of Bombay, existing at the present day, and which I have seen as far north as Baroda; it most probably belonged to a wooden style, and differed from that which we find on the old Buddhist sculptures. These sculptures, as well as the Buddhist caves, are so unanimous in telling us of only one style, that I venture on this suggestion of the existence of another style with great hesitancy. The Jaina temples at Moodbidri, in Kanara,* are the only links of evidence I can recall at the moment, and they, I think, were either built by an

* It may perhaps be as well to mention that it is the architecture of these temples which is referred-to by Colonel Yule in his remarks as being in Malabar. Kanara is on the Malabar coast.—W. S.

architect from the Himalayas, or another wooden style was to a certain extent practised at some time along the western coast of India.

The roof of Shah Hamadan's mosque in Srinugger is of wood, and it shows that the Himalayan roof was practised in Kashmir; in that valley there are some fine old temples, in which there are forms manifestly derived from the Greek, but they are mixed with a trefoil arch, and lines which might suggest a gothic influence. The sloping lines which give this effect are of course not gothic, but are derived originally from this Himalayan roof. This is very clearly established by the temples of Pandrethan and Payetsh, where the roof still remains; they are in stone, but their form has been derived from the Himalayan. Mr. Fergusson dates these Kashmir temples from 600 to 1200 A.D. It had become an established style, and the sloping roof produced certain conventional lines, which is a marked feature of these temples. This is the only evidence I am aware of as to dates, but it shows, I think, that the sloping roof of the Himalayas existed all but contemporaneously with the round roof of the Buddhist period.

I can myself easily accept the antiquity of those forms which were peculiar to the Himalayan villages. I was impressed with the marked primitiveness of almost all that I saw. Their religious ceremonies bore a greater resemblance to those of Palestine, in the time of David, than to anything to be found in India. Every village has its khuda, or god, which is carried about with staves on men's shoulders, very much like the ark of the covenant. I could not find out what was the sacred object contained in these khudas, or devis, for both names were applied to them. There is a framework of wood, covered with pieces of bright cloth, which hang down like a skirt; they are not all alike, but the Chini khuda had some bronze masques surrounding the upper part, and above them was a large mass of yak tails, dyed of a deep red colour. These objects are treated as if they were royal persons. Attendants follow them with chowries, an emblem of royalty in India, and I have seen them taken out for a "*hawa khana*," or a constitutional,—drums, music, and attendants following. The god of one village goes at times to visit the god of the next village, and all the details of the ceremony are similar to those of Rajahs receiving each other. On festival days the villagers dance round these devis as David danced round the Ark; at one I saw kids sacrificed, and the blood offered on the point of a finger (see Ex. xxix, 12, 19, 20). At the same time fruits and flowers were presented. Some of these gods I understood were called "Maha Deo," and others "Parbuttie," but in what form they were intended to represent these favourite Hindu deities I could not make out. They bore no resemblance to any of the gods of India that I could perceive. These gods and the rites performed in their worship seemed to me to belong to some primitive faith which had existed undisturbed in the safe recesses of the mountains. I asked if there were Brahmins among them, and they said no; the villagers themselves performed the rites. They had no caste among them; there were only kate-wallahs and coolies,—that is field owners and labourers. This does not savour of Hinduism, and they were not Buddhists. This peculiar worship of the hills existed as far as China, and a few villages higher up, but beyond that Buddhist monks and monasteries alone were to be found.*

* Both Lloyd and Gerard state that there were no Brahmins to the east of Serahn, at which place, Gerard states, there is a grand temple to Bheema Kalee, "well built, and has two very lofty turrets with Chinese roofs; and between them a third rises still higher, crowned with a gilt ball, under which is her image. Six or

Every village has its khuda, and the temple is merely the house in which it dwells. The temples were generally in the centre of the small cluster of houses which constitute these hill villages; I saw some temples which were away from the villages, and situated in sacred groves of the deodar, the trees of such groves never being cut down except for the repair of the temples, reminding us of the cedars of Lebanon, which yet retain a sanctity from their having been used for Solomon's temple,—the link being all the more remarkable from the *Cedrus Libani* and the *Cedrus Deodara*, being trees of the same botanical genera.* These sylvan temples of the Himalayas are, in some cases at least, without khudas; and the probability is, judging from a ceremony I witnessed in one of them, that they are only used for important days, when the village brings its god to them.

I am sorry that I did not make plans of these temples; one reason was that I did not care to force my way into them, lest the prejudices of the villagers might take offence. That of Chini had a porch [Illustn. xxxi], and so far as I could see into it, the body of the house was only a large room to hold the khuda. There is an upper storey, but what it was for I have no information. Here, I think, there was no special plan, but when I look now at the drawing of the Chergaon temple, I regret not having a plan of it. It has the appearance of having been built according to some settled design, with special arrangements in its parts. Although nearly all the villages had khudas, such as I have described, yet I know that here and there temples of a more Hindu kind exist, and it is quite possible that the circular roof of the Chergaon temple [Illustn. xxxiii, fig. 91] may be the sikra over a lingam; although the roof of that part is circular, the walls under it are square, and built of wood and stone, while all the rest of the temple is of wood. I only camped for the night at Chergaon, and have no recollection of seeing into the temple, so I speak thus with reserve as to what it contained. I am inclined to think it was exceptional in its form among these hill devi-ka-makans, or god places, as they are familiarly called, and you will see how marked is the difference between it and the Chini temple, with which I am very familiar, having lived for two months in the village.

The most of these hill temples are elaborately carved, and I give a drawing of the carving [fig. 89] on the porch of the Chini temple, and on the upper portion of the dharmsalah [fig. 90] belonging to it [Illustn. xxxii]; the latter shows the wooden pendants, some of them broken off, which were described as hanging from the cornice of the roof in the Serahn palace [fig. 81]. A drawing [fig. 80] shows how in some cases the wooden beams mixed with the stonework are decorated, from a small temple at a place called Jacko, on the way up to the Roopin Pass; it seemed to be old, and the carving on these beams was very delicately done. The design, it will be noticed, on each beam is varied. I also give a carved

seven years ago," Gerard writes in 1821, "human sacrifices were offered up to Bheema Kalee; but they have been discontinued since the British conquest of the hills. The temple is attended by Brahmins; and this is the easternmost part of Bussahir where any of that caste is to be found." There are none in Koonawur. (Vol. II. p. 302.) Koonawur is that part of the Sutlej valley to the east of Serahn, which includes Chini.—W. S.

* "This species of pine called 'keloo' (Deodar) is almost everlasting: it resists the attacks of every kind of insect, and it is consequently much used in building. Granaries and chests for grain are invariably constructed of this wood. The keloo seldom occurs below 6,000 feet, and its upper limit is nearly 12,000 feet; in a few favourable situations I have found the latter above 12,300 feet. An oil is extracted from the keloo by a process similar to that for making tar. It has an agreeable odour, and when rubbed upon the more perishable timbers, renders them less liable to decay." (*Gerard*, Vol. II. p. 296).—W. S.

terminal from the Chergaon temple [fig. 91*a*], which presents a curious compound of animal forms. The carving of these temples always struck me, and claimed my admiration, for although almost always rude, it was generally bold and artistic.

In front of the Chini temple stands a picturesque structure, called a dharmsalah, which word is here used to mean Rest-house, and each village has one. Travellers use these buildings, as they are the only hotels in that part of the world, but they are also used in the religious ceremonies, for the devi is at times brought out and placed there. The dharmsalah [Illustn. xxxi, fig. 88] stands on a rudely paved circular space, similar to the threshing floors of the villages; at one of the festivals in Chini the devi was brought out, and carried round the dharmsalah, when rude music, with long brass horns and drums, was kept up, the men and women holding each other by the arms, intertwined behind their backs, singing all the time, swayed backwards and forwards, as if salaaming the devi, and thus they went round in a ceremonial dance, followed by the devi, born on the shoulders of two men, with others near it as attendants. Between the dances the devi was placed in the dharmsalah. At the temple in the woods near Chini there is a dharmsalah, where the devi was placed when the blood, fruit and other things were presented to it. From this it will be seen that the dharmsalah may be looked upon as an appendage of the Himalayan temples, standing in front of them; although the purpose to which it is applied is very different, yet it might be compared to the *mantapa* or porch of a Hindu temple.

Many forms in Himalayan architecture have been copied from the plains, and the accustomed eye can easily detect such imitations. I have said nothing about them, as my object has been to describe forms which are peculiar to the hills. I must make one exception, and that is in reference to temples with sikras; that is the curvilinear tower or steeple, so peculiar to Hindu temples, and those of this form in the hills it may be supposed are copied from the architecture of the plains. I presume that the emblems in them are similar to those of the plains, and that the worship will also be according to the same ritual. While sketching one of these temples at a place called Batwarri, on the Ganges, and noticing rents in the walls, I said to one of the villagers that it would soon tumble down, he said, "No, Sahib, it will not fall, Maha Deo built it." The existence of a legend that a god built a temple is worth noting, but I give it here as we may deduce from it that Maha Deo, or Siva, was worshipped in this temple. How far the worship of Siva prevails in the hills I cannot say, but in that part of the Sutlej valley with which I am familiar the most of the temples, if not the whole of them, belonged to the rites already described. The Chergaon temple may have been a Saiva temple, but if it was it is the only one I noticed. In the Batwarri temple, the sikra is built of stone, except the summit, and instead of the usual rounded member, called the *amalaka*, there is a square frame work of wood, covered with a pyramidal roof of the same material. I give a drawing of the temple at Gangootree, which has this peculiar arrangement [Illustn. xxix, fig. 83]. The origin of the Hindu sikra is very uncertain; suggestions have been made, but they all fail to satisfy, and it may be said that the question as yet remains unsolved. What the terminal of the Hindu sikra represents is equally doubtful; to the ordinary difficulties of the case we have here added the curious problem as to why the men of the hills copied the sikra, and left out its terminal features; at the same time supplanting the want with a wooden construction of their own. The case is here given, but I regret being unable to give judgment upon it. This

increases the regret at not knowing to what deity the Chergaon temple is devoted, but it suggests that if it is a Saiva temple, we have there the sikra peculiar to the Himalayas, and if that is the case, then the wooden roof over it is no doubt looked upon as a canopy, and is a mark of respect to the emblem beneath, and this might explain why they add it on to the sikras copied from the plains. I have in one of my books another sketch of a very rude temple* with a similar round canopy resting on a square frame, which leads me to suppose that it has a specialty in the minds of the hill men, and causes me to give this as a suggestion. The temple at Gangootree is sacred to Gunga-jee; that word being the respectful manner of referring to the Ganges, represented by a female figure and a crocodile. There are a few rude houses at the place for the Brahmins, who attend in the summer months when the pilgrims arrive. In the winter the place is deserted, as it is covered with snow at that season, being about 12,000 feet above the sea. It is called "the cow's mouth," but the glacier from which the Ganges issues is about twenty miles higher up; there is no road or house beyond the temple. Hindus occasionally ascend and wander upwards till they are lost among the snow, a proceeding they are induced to practice from a belief that it is certain to insure their translation to Kailasa, the heaven of Siva, which, in that region, is popularly supposed to be somewhere among the higher peaks of the Himalayas.

Himalayan Bridges. These works are peculiar, and of great variety [Illustn. xxxiv]. Their construction in each case is the result of the materials to be found in the different localities. In the Darjeeling part of the Himalayas, where the bamboo is plentiful, they are made of that most useful product. In Thibet, where wood is scarce, the branches of bushes,—twisted birch-twigs, according to General Cunningham,—are made into a kind of rope, and three of these form a bridge; one rope of this, about a foot in diameter, is the footpath, and the other two act as hand-rails. I never had to run the risk of crossing one of these bridges: they have no support in the middle, and their appearance would suggest a race of Blondins who can venture on such a fragile swing.† In the Sutlej valley and the regions around, a favourite kind of bridge consists of one rope, made of the hair of the yak, or wild cow of the Himalayas. The rope is stretched across the river from two poles, a piece of forked wood is laid on it, to this the passenger is tied, and by means of a rope attached to the piece of wood, and pulled from the other side, it slides along with the person dangling to it over the roaring torrent of icy waters, which all the rivers contain thereabouts, in a position which is neither comfortable nor dignified, and with the certainty that, if the rope breaks, death is all but certain; luggage is sent over by the same process, and at a place near Chini we had dogs and goats ferried over by the same means. This peculiar arrangement is called a *joola*. I have sketches of these, but their constructive features scarcely entitle them to a place in this Paper. There are bridges also of a more substantial kind, and these are worthy of some notice. They form a good illustration of the Hindu principle of construction, that is, of the use of the bracket, to reduce the length of space to be bridged over. On each side of the river a pier is constructed, generally of wood and stone; into this trees are built, projecting in the

* A small temple at Leepee, three marches beyond Chini. The people at this village were nearly all Buddhists, but there were some Hindus, and the small temple may have belonged to them.—W. S.

† Chug-zam is the Thibetan name of this kind of bridge given by General Cunningham.—W. S.

direction of the bridge; in the sketches I have, where a substantial bridge of some size is intended, three layers of these trees seem to have been the usual arrangement. The second layer has the trees extending beyond the lower, and the third extending again still further; these beams all slope upwards towards the river. The pier is built so as to hold these secure, and to support the central part of the bridge as well. A similar construction is raised on the other side. This arrangement, you will see, produces what may be called two brackets; and a series of trees are laid across from each; over all, transverse pieces of wood are laid, to form the roadway, and in some cases a railing is put up on each side, to give more security to those passing. Fig. 94 will convey a fair idea of these Himalayan bridges; it is on the Tonse River, and has been a substantial erection, but it is now somewhat the worse for wear; in it the details can be easily followed. Some years ago I saw a picture of a bridge from Norway, or it may have been Sweden, so like to these Himalayan bridges, that it might have passed for one of them. It should be stated that in the Himalayas, as in every other part of the world, streams vary in size, and bridges vary also in every detail; I have passed over some very simple structures in which only the rudimentary forms above described could be detected, and many of them in such a shattered condition, from the want of repairs, that a respectably brought-up barn-door fowl would have seriously considered the propriety of crossing before venturing on such a rash proceeding.

I give a slight sketch of one of these bridges on the Sutlej at Wangtu [fig. 92]; as this is on the Hindustan and Thibet Road, I assumed that our engineers* had had something to do with it, although it is constructed in all its details on the native plan. The piers at each end are raised up, and form doorways, the object of which is evidently to give weight to support the large deodar trees built into it. These piers are built in the stone and wood manner so peculiar to the neighbourhood.

In Kashmir the bridges present some of the features already described, combined with others peculiar to the locality. The Jhelum, the Hydaspes of the Greeks, has its sources in the "Happy Valley," and it flows with a considerable body of water at Srinuggur, where it is spanned by a number of bridges. My illustration of one of these Kashmir bridges is that at Sopur [fig. 93], near the pass of Baramoola, through which the Jhelum flows out on its course to the Punjab. The width of the river necessitates supports in the middle, and it is their construction which is the remarkable characteristic. A plentiful supply of pine-trees has here led to the plan adopted. Over the spot intended for the pier a layer of logs is arranged; over these another is placed crosswise, then another, and this is continued till it touches the ground at the bottom. The piling-up of the wood is still continued till the desired height for the road-way is reached, taking care to spread out the top of the pile in the direction of the line of the bridge, thus in a very rude manner producing the bracket principle, to lessen the distance from pier to pier. The piers on the land at each end are generally built of stone, and wood is also used in the Himalayan principle. None of these Kashmir bridges have railings, the absence of which strikes the eye of a European on first seeing them. One of the bridges at Srinuggur, built in this style, has a row of wooden shops along each side. I thought at

* I am obliged to General Maclagan for a correction on this point. It will be seen further on that he gives the span of this bridge as 120 feet. As the General is an engineer officer who has served long in India, his authority on such a matter must be safer than my very uncertain recollection.—W. S.

first of giving my sketch of that bridge, as it is very picturesque: but I have given the Sopur bridge, as it is exceptional, and more characteristic of the style in Kashmir.

THIBETAN ARCHITECTURE.—From fragments of walls left of the old Buddhist monasteries in the Jellalabad valley, I came to the conclusion that they had a slope inwards. There is every reason to believe that during the Buddhist period considerable communication with that region, as well as with Gandhara, existed by means of the Indus valley through Kashmir to Thibet, and there is reason to suppose that some architectural influence was carried by this route. In Thibet the sloping walls of the houses is a marked characteristic. This feature is not confined to one part of Thibet. I do not know how far Huc and Gabet are to be trusted in the matter of their illustrations, but in my copy of their travels there is the tomb of a Grand Lama of Thibet, and in it the walls have a slope. The late Captain Gill, who was murdered last August near Suez, describes, in his *River of Golden Sand,* where he touched the country of Thibet on its extreme south-east corner, and he gives a picture of Man-tzu houses from that locality, and the sloping walls is a marked feature. Near the Summer palace at Peking there is a dilapidated place, which I was told had been built, to show a former emperor what the Thibetan monasteries were like; in it the wall as well as the window slope. Chinese houses, from their being essentially wooden, have no batter; but the walls of Peking, which are of brick, have it, and so have the brick buildings upon them; it is the same with the great wall of China. Not only the wall itself, but the gateways and forts to defend them, have all this character in their construction. This is a vast space over which to find extended one peculiar manner of building walls. I presume that it also extended into Afghanistan before the Greek influence arrived there, and that it explains some of the features I discovered in the remains, and which will be found described in the Paper I read to you about three years ago.* Some of the oldest of the Buddhist caves in India show a slope, but as their forms were derived from wooden types, it probably had a different origin. The tomb of Toglook near Delhi, is remarkable for its sloping walls, and it may be a borrowed reminiscence of some structure in Afghanistan or Central Asia.

Thibet is a rainless country, the part I visited is almost wholly so; rain falls as seldom as in Egypt. Some snow falls on the higher peaks, and as it melts, streams come down, which are used to irrigate the fields with. It is not a sylvan country, which will explain why the architecture is not wooden.† Stones or sun-dried bricks, are the building materials.‡ There is little or nothing of an architectural character in these Thibetan buildings

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* See the TRANSACTIONS, 1879-80, pp. 37-64.

† "The Tartar villages are neat, and are frequently in detached portions. The houses are flat roofed, and covered with earth. They are ill-built, on account of the scarcity of wood, which is a necessary material in the construction, where stones cannot be cut. The only trees on the Chinese and Ladak borders are to be seen where man has settled, and they are all reared by his industry. These are poplars and apricots." (*Gerard,* Vol. II. p. 208.) Gerard did not go beyond the Spiti valley, but his description is correct enough, and applies to the villages I saw further into Ladak.—W. S.

‡ "The houses usually consist of two or three storeys, and sometimes of four. The foundations and lower parts of the walls are built of stone, the upper walls of large sun-dried bricks, 20 by 10 by 16 inches. In the better houses some of the rooms are of considerable size, 25 feet long and 18 feet broad; but they are always very low, the highest not exceeding $7\frac{1}{2}$ or 8 feet. The roofs of these rooms are always supported by plain wooden pillars. The roof is formed of poplar spars 5 or 6 inches in diameter, peeled white, and laid only 1 to $1\frac{1}{2}$ feet apart. The beams are covered in with small straight pieces of poplar branches, about 1 inch in

which it will be necessary to describe; the illustration I give conveys a fair idea of their details [Illustn. xxxv]. Height is one of their characteristics, and the object of that, like the lower storey of the Sutlej houses, has defence in all probability for its object. The only detail I shall call your attention to, is the manner in which a lintel is produced. They built in bricks, or small stones, and had not discovered or did not use the arch. As already stated, trees are scarce; in some places small kinds of trees grow, but seldom anything large enough to support a weight above it. The result is that by means of the smaller wood a lintel is constructed, by laying pieces in tiers, one above the other crosswise, till a sufficient strength is produced. It will be noticed from the drawing that doors and windows are all treated in this way. We have here, from this process, an appearance like the dentils of classic architecture produced; and its existence in this part of the world may possibly explain why they are such a marked feature of the Indo-classic style of Gandhara and Afghanistan. I mention this as a suggestion only, for the dentils on the old Buddhist works in these regions were naturally ascribed to the Greek influence. That was my first opinion regarding them, but I confess now to doubts.*

[Remarks by Colonel Yule, C.B., V.P.R.A.S.]

There are two ways no doubt in which resemblances of structure originate—one where like circumstances and like materials lead to the same expedients; but also another which points to actual or presumable historical or pre-historical connexion; and it seems to me that Mr. Simpson's drawings suggest instances of both kinds. We have these bridges described by Mr. Simpson—*sángas,* as they are called in the Himalayas—corbelled structures, in which beams of deodar are projected from either bank, and loaded on the landward side with stones; longer beams project beyond these, and longer ones again, until the middle gap is narrow enough to be spanned by one long beam, perhaps itself 40 feet in length, which completes the bridge. Now, this seems to be a system which may originate in various parts of the world from like circumstances, and does not involve a probability of historical connexion. You find the same construction of bridges in the mountains west of Szechuen, in China.† There, indeed, the use may have been derived from the same source as in the Himalayas, for both regions belong to the same great Thibetan plateau. But you find it also in Kurdistan or its borders. There is an engraving in one of Layard's books which shows precisely the Himalayan

diameter, peeled white, and placed touching each other. Generally they are laid straight across the beams; but sometimes at different angles, in the alternate intervals, so as to form a pattern like a herring-bone. The whole is then covered with a layer of leaves and a thick coat of well-beaten clay. The floors are generally of earth, but the better sort are paved with slit pebbles, about the size of turkeys' eggs, set in clay with the flat surface upwards. They form a clean, hard, smooth and lasting floor." (*Cunningham's Ladàk*, p. 313.) "The houses of the poorer classes are generally of two storeys, the lower being appropriated to their cattle. The roofs are much more coarsely made, and the rooms are small and very low, being sometimes under 6 feet in height. In Ladak the upper storey is usually reached by a flight of earthen steps; but in Lahul, by the sloping trunk of a tree notched into steps." (*Ibid*, p. 314.)—W. S.

* In Mr. Fergusson's *Indian and Eastern Architecture*, p. 313, the doorway of a temple at Tassiding, in Thibet, is given, where these dentil-like forms will be seen; also at p. 314, where there is a drawing of the porch of the temple at Pemiongchi.—W. S.

† *E. g.* a woodcut of a bridge over the Denju, in Easten T hibet, in "Im fernen Osten" (Travels with Count Bela Széchenyí), by G. Kreitner, Vienna, 1881, p. 913.—H. Y.

bridge over one of the tributaries of the Tigris—the Zab, I think. I have seen also a description of exactly the same bridge as used in the Andes. In these cases one presumes that the similarity arises from similar needs and circumstances. In fact, it is but the application to timber structure of the "false arch," or "horizontal arch," as it has been called, which in stonework you meet with in most ancient structures, all over the world—in the Treasury of Atreus, at Mycenæ; in the *Nuraghe* of Sardinia; in the cairn-tombs of our own islands, such as New Grange in Ireland, and Maes-how in Orkney; in temples in India, in Java and in Camboja; in the tombs of Kertch and of Etruria, and in the ancient palaces of Yucatan. But I very much doubt if that applies to resemblances of structures such as the Himalayan roofs [Illustns. xxix, xxxi and xxxiii] with roofs which are found in China indeed, but not in China alone, for similar or closely analogous forms are found in all the countries between India and China; in Burma, in Siam, in Java, and—which is perhaps the most curious circumstance of all—in Malabar. The resemblances are strong, the chain is tolerably perfect, the climate and circumstances vary greatly, and these resemblances cannot be due to accident or natural result. Nor does this similarity stand alone. There are other resemblances between Chinese architecture and what is known of old Indian architecture which confirm this impression. Thus, in China and in all the countries beyond India that I have mentioned you find the same kind of palace, or palace-hall rather. You will see what I mean in the pictures of the Palace of Peking—a great, elevated mass of masonry forming an apparently solid base, and upon that a great pillared structure of timber, with a roof. A cut of the Peking building is given by Mr. Fergusson in his *History of Indian and Eastern Architecture*, p. 707. Substantially the same kind of palace-hall is found in Burma, in Siam and in Java; and though I am not certain of any surviving instance in India, you have what is undoubtedly a derivation of it in such buildings as the great palace-halls at Delhi (the diwán-i-ám and the diwán-i-khás), in which you have the same solid basement of masonry; but, instead of the timber superstructure, an arcaded hall of masonry of highly architectural character.* It is probable that this style of palace-hall—I mean the solid base with the timber colonnaded superstructure—had its origin in India, or at least that it was from India that it spread, with other Hindu institutions, to the countries of the further East. In the architecture represented in the ancient Indian sculptures [Illustn. xxx], though I do not recollect anything exactly analogous to the palace-hall of this kind, you have the masonry substructure with the upper inhabited structure of timber, and Mr. Simpson has pointed-out most truly the strong resemblance to this which is preserved in the domestic architecture of the Himalayas. Up to the eaves the analogy is most striking; then it fails altogether. There are many illustrations of the ancient roof in that treasury, Mr. Fergusson's book, derived from the Buddhist caves, which exhibit in their excavated formation an imitation of the timber structures of their place and time, just as the Lycian tombs in the British Museum do of the timber of their place and time. Such illustrations are at pp. 111, 135, 168—the last from one of the Bharhut bas-reliefs. This structure of roof is very curious. Its form is that of a horseshoe, or nearly so, formed by ribs of timber like those of a ship, or like those of the great tun of Heidelberg, overlaid by

* A view of the palace at Amarapura, in Burma, will be found in my narrative of Major Phayre's Mission to Ava; also in Mr. Fergusson's book, as above, p. 627. In the latter also is a cut of the palace-hall at Allahabad, after Daniell (p. 583).—H. Y.

timber purlins. And sometimes there seems to have been a sort of truss formed of several of these horseshoe ribs placed concentrically and bound together by radial ties. It is difficult, as Mr. Simpson said, to conceive in what way so peculiar a structure originated. The only thing I could ever think of as its origin is in structures of bamboo, where the horseshoes were of bent bamboo, and that this was afterwards imitated in carpentry, as the carpentry has been imitated in stone. We see that not only was the carpentry imitated in stone, but that in some of the caves of Western India, as in that of Karli, those actual ribs of timber were introduced as if supporting the curve of solid rock above them—a very remarkable example of the conservatism in human art. I believe that the study of the subject would elicit the trace of many architectural features which have spread from India to China and the intermediate countries; but that is a matter which would require much preparation and very ample illustration.

H. YULE.

[Remarks by General Maclagan, R.E.]

With regard to the use of timber in stone walls, it may be observed that there is another application of it besides that noticed in the Paper. Mr. Simpson has described the way in which the beams in the contiguous walls of a building rest upon each other, so that they form a casing of timber which would stand independently of the stone wall. This is the construction of the upper part of the temple near Simla, noticed by Mr. Simpson [Illustn. xxix, fig. 82], but in the lower storey, as may be seen in the picture of this building by a well-known Indian photographer, the horizontal timbers are laid at wide intervals, and not fitted to other timbers on the adjoining sides. The purpose which they serve is to distribute the pressure on the stone walls below. With respect to the form of the buildings in those Indian hills, as probably dictated by local circumstances, it may be surmized that the very broad projections in the upper storeys, either in the form of a gallery, as in Illustn. xxix [fig. 82] and also in the Serahn or Saráhan Palace [Illustn. xxviii], or of wide projecting eaves supported on strong verandah-posts, are meant to afford some open-air shelter in the winter and to keep the snow from the doors and walls. The snow, which is soonest cleared off the steep upper part of the roof, slides down and is retained on the lower part, which is nearly horizontal and very strong. Mr. Simpson has described in his Paper the "fringe," as it may be called, of thin wooden pendants [figs. 82, 90] running round the edge of the roof, which is a frequent ornament. It is possible that this ornament was originally suggested by a row of icicles. The dripping over the eaves of the thawed snow collected on the lower part of the roof, followed by frost, forms just such a fringe of icicles. Mr. Simpson has mentioned another use of a local material—the sheets of birch-bark laid on the flat roofs of simple buildings to carry a layer of earth or other covering. The birch-bark (which is easily stripped off the trees in numerous folds) is also used for the inner wrapping of parcels, and for writing on. Mr. Simpson notices another interesting matter, which is the construction of bridges of the kind called *sanga*, illustrated by the bridge he describes at Wangtu, on the Sutlej River. Mr. Simpson observes that, as this bridge was on the high-road, called the Hindustan and Thibet road, he supposed that British engineers had had something to do with it. Since he was there a new bridge has been built by British engineers; but it was the old native bridge which he saw. The new bridge is of the same construction, but more solidly built, and of a span of 120 feet. By adopting the native construction the work was executed with materials procurable

on the spot, and by local labour with familiar appliances. There is a native bridge of the same kind and of longer span further up the Sutlej, just within Chinese territory. In this bridge the beams or rows of beams which project one beyond the other in successive courses are horizontal, instead of tilted upwards, as in the Wangtu bridge and others. In all alike, the projecting timbers of the abutments stretch out over the stream till the opening left in the middle can be spanned by single timbers. The construction with horizontal beams closely resembles that of the masonry arches built with successive horizontal courses of large stones, which Colonel Yule has described, and of which there are some well-known instances in India, for instance, in the large arch at the Kootub minar, near Delhi, which is usually explained by its having been a Mohammedan design executed by Hindu workmen. The construction of these timber bridges has an interest for us just now, as the principle of stretching-out supporting arms for the piers and abutments until the space left between can be crossed by a single girder is, in a certain way, that which is adopted by Mr. John Fowler in his design for the bridge over the Forth, near Edinburgh, which will have the largest single span of any bridge built up to the present time. ROBERT MACLAGAN.

[Note communicated by James Fergusson, C.I.E., D.C.L., F.R.S., *Past Vice-President.*]

In this Paper Mr. Simpson touches on several of the most interesting problems connected with the study of Indian architecture, and though the space at his disposal is not sufficient to enable him to treat any of them in an exhaustive manner, he throws considerable light on each as it passes through his hands. It is, however, only by such rapid sketches over the wide field which is occupied by the collateral branches that it will ever be possible to arrive at any satisfactory conclusions as to either the origin or development of Indian art.

Perhaps the two most striking peculiarities of Indian architecture are the decidedly wooden origin of all its principal features and details, and the aversion the Indians always exhibited to the use of the radiating arch until it was forced upon them by their Mohammedan conquerors. On both these points Mr. Simpson's sketches throw considerable light, and he approaches the subject from so novel a point of view, that his mode of treatment of the subject has a great charm of originality. Nothing for instance can be more suggestive than the solid square basement on which the palace at Serahn [Illustn. xxix], and the devi-ka-makan [Illustn. xxviii], near Simla, are raised—one of their minor peculiarities is the use of timber for mortar. In a country where stone and wood are abundant, but lime is not, nothing can be more ingenious than the alternate layers of timber, binding the courses of stone together, and the mode in which they are treated constructively as well as ornamentally [Illustn. xxvii] is as curious as it is novel.

The most interesting points with regard to these solid bases, is the mode in which they are made to support an overhanging structure of wood, which is the use for which they were originally designed and to which they were exclusively applied. In the middle ages, when a house or castle had to be fortified, it was accomplished by making the lower parts of the walls inordinately thick, and the openings as few and as small as possible—rendering the lower storeys nearly uninhabitable, and in a hot country they would have been wholly so; the Indians cut the knot by abandoning the lower storey entirely to purposes of defence, and constructing on it overhanging galleries like the *herses* that Viollet-le-Duc was so fond of

illustrating, which in both instances rendered this form of house singularly adapted for defence. The Indian plan had the advantage of the mediæval one, that the dwelling-house was all together in one storey, and formed a light and airy abode without the necessity of leaving well-holes or other means of lighting or ventilating the under storeys. Such a mode of construction could only be used where the dwelling houses were habitually constructed in timber, but such seems to have been the case in India from the earliest time. As Mr. Simpson points out, the representation of palaces and dwelling houses on the gateways at Sanchi and elsewhere, dating from about and even before the Christian era, afford evidence that this mode of construction was employed in the earliest ages in India. In these bas-reliefs all the palaces and dwelling houses are represented or constructed wholly in wood, but raised on solid stone basements precisely as these Himalayan buildings are at the present day. This mode of construction cannot now be said to be adopted on the plains, and it is therefore the more interesting to find it still surviving in the Himalayas, with traces of it still existing in Thibet, and extending as far eastward as the palaces at Peking.

Another point of considerable interest which Mr. Simpson's sketches illustrate, is the formation of the roofs, showing that they were steepest in the centre, where protection was most indispensable, and thus the slope gradually diminished over the external parts, that is to say in the eaves where leakage was least to be dreaded. As long ago as 1855, I pointed out in my *Handbook of Architecture* (woodcut 92),* that this was the cause of the hollow curve of the roofs in Chinese architecture, but Mr. Simpson's sketches are the first I have seen that make it actually clear how this was developed. From Kashmir and Nepal through all the Himalayan valleys and the extreme eastward of China this type of roof prevails, with local variations of course, but the curious point is that it is not found in India, except indeed in the most exceptional cases. At Sanchi, at Bharhut, in all the western caves, wherever the roof is represented in the rock or on any bas-relief, it is invariably a tunnel or waggon vault. Among some thousands of representations of roofs carved in stone in ancient times, there is not one, so far as I know, with a hollow external curve, though all are copies of wooden construction, and express their wooden origin more distinctly. There is not a trace anywhere of a stone vault or anything resembling it; though at first sight they sometimes seem to resemble stone construction. Everything is really copied from an original as essentially wooden, and such buildings are illustrated in these sketches. As the practice of covering buildings by semicircular wooden roofs does not now prevail in India, except in solid stone imitations of them, it is not known how the interior was protected from the weather, and unfortunately Mr. Simpson's sketches, being of the antagonistic form, throw no light on the subject.

The native huts, roofed with bamboo frames and covered with thatch, would afford a type which might suggest an imitation. But the caves show no trace of bamboo forms, and I can

* In my *History of Indian and Eastern Architecture* I have treated of this subject thus :—"One of the most remarkable peculiarities of their houses is the almost universal concave form of roof, which writers on the subject have generally referred to as a reminiscence of the tent of the Tartars, who are supposed to have introduced it. The authors of this theory, however, forgot that the Chinese have been longer out of tents, and know less of them, than any other people now on the face of the globe. The Tartar conquest, like our Norman one, has long been a fusion rather than a subjection, and does not seem to have produced any visible effect on the manners or customs of the original inhabitants of China. It may also be observed that the typical form of the roof of a Tartar tent was and is domical, like those represented in the Assyrian sculptures, and seldom, if

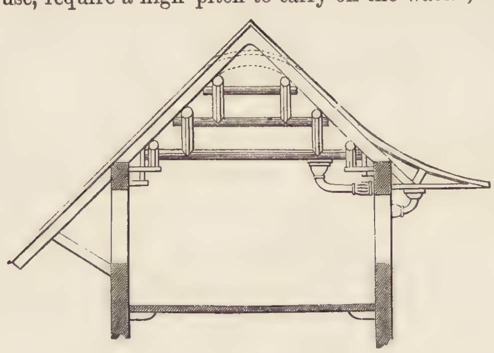
hardly conceive temples and palaces covered with thatch, besides, it would almost certainly be possible to detect its thickness in the representations if it had been used. The sculptures suggest a metal covering—of copper (?)—but some further discoveries are required, or some suggestive sketches like those of Mr. Simpson's, before even hazarding a guess.

The wooden bridges depicted in Mr. Simpson's sketches are a curious illustration of the tendency to carry a principle to excess, which is characteristic of a rude people, and of applying the forms appropriate to one class of materials to another to which they certainly are not appropriate. The so-called horizontal arch has certain advantages when employed in the construction of domes, which early led to it being adopted for that purpose. By bracketing stones forward one beyond another, till they meet in the centre of a circle, a dome is constructed which is perfectly firm and has the enormous advantage that it has no lateral thrust. A pointed arch can also be formed in the same manner, which has nearly though not quite the same advantages, and these sufficed for the very rare occasions on which the Hindus attempted stone roofing, and that certainly was not before the tenth or eleventh centuries of our era; but to apply that principle to wooden construction [fig. 94] was unscientific and clumsy to a degree. In a single spanned bridge the timbers must project as far behind as in front of the point of support, in order to balance, and although the outer end can be weighted with stones or other materials, there is waste of power to counteract the weight of the central part. When there are several spans this principle is not so objectionable, but any kind of strutting or diagonal framing would afford the same strength with a great economy of material. It was, however, this principle of bracketing, both in stone and in wood, that led to the sloping jambs and shortened lintels so characteristic of the architecture of Thibet and Northern India generally.

The paramount interest in Mr. Simpson's Paper, it appears to me, is that it calls attention to the survival in the valleys of the Himalayas of a wooden style of architecture which is known from the monuments to have prevailed exclusively in the early ages of the art. It prevails now almost as exclusively—except for a peculiar class of monuments—in Burma and other countries of the East, but in India itself it has been superseded by the lithic styles imported from the West.

JAS. FERGUSSON.

ever, constructed with a hollow curve, so that the argument tells the other way. Be this as it may, the form of roof in question arose from a constructive exigence, which others would do well to imitate. In a country like China, where very heavy rains fall at one season of the year, tiled roofs, such as they almost universally use, require a high pitch to carry off the water; but the glaring sunshine of another season renders shade to walls and windows absolutely necessary. If (as on the left of the annexed diagram) the slope of the roof is continued so far out as to be effective for the last purpose, the upper windows are too much darkened, and it is impossible to see out of them. To remedy this defect, the Chinese carry-out their eaves almost horizontally from the face of the walls, where a leak becomes of slight importance; and then, to break the awkward angle, caused by the meeting of these two slopes, they ease it off with a hollow curve, which not only answers the double purpose of the roof more effectually, but produces what the Chinese think—and perhaps rightly—the most pleasing form of roof."—J. F.



VI. ARCHITECTURE IN THE HIMALAYAS (XXVI)

C F Kell Lith. Castle St. Holborn London E.C.

FIG. 78, SKETCH MAP OF THE HIMALAYAS.

VI. ARCHITECTURE IN THE HIMALAYAS (XXVII)

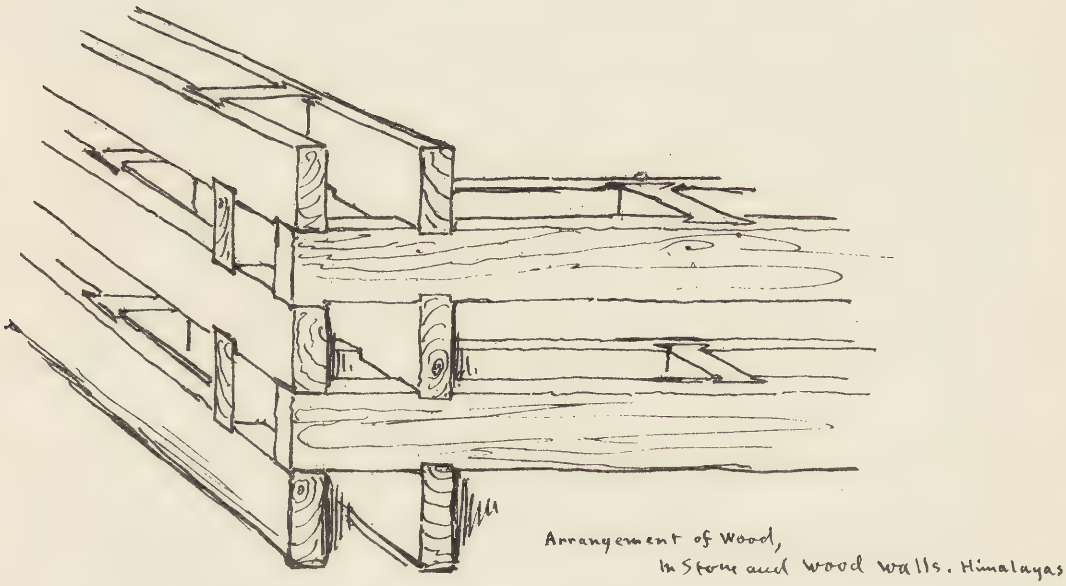


FIG 79, ARRANGEMENT OF WOOD, IN STONE AND WOOD WALLS, HIMALAYAS.

FIG. 80, COMBINATION OF WOOD AND STONE, TEMPLE AT JACKO.

C.F.Kell, Photo-Litho. Castle St Holborn, London, E.C.

VI ARCHITECTURE IN THE HIMALAYAS (XXVIII)

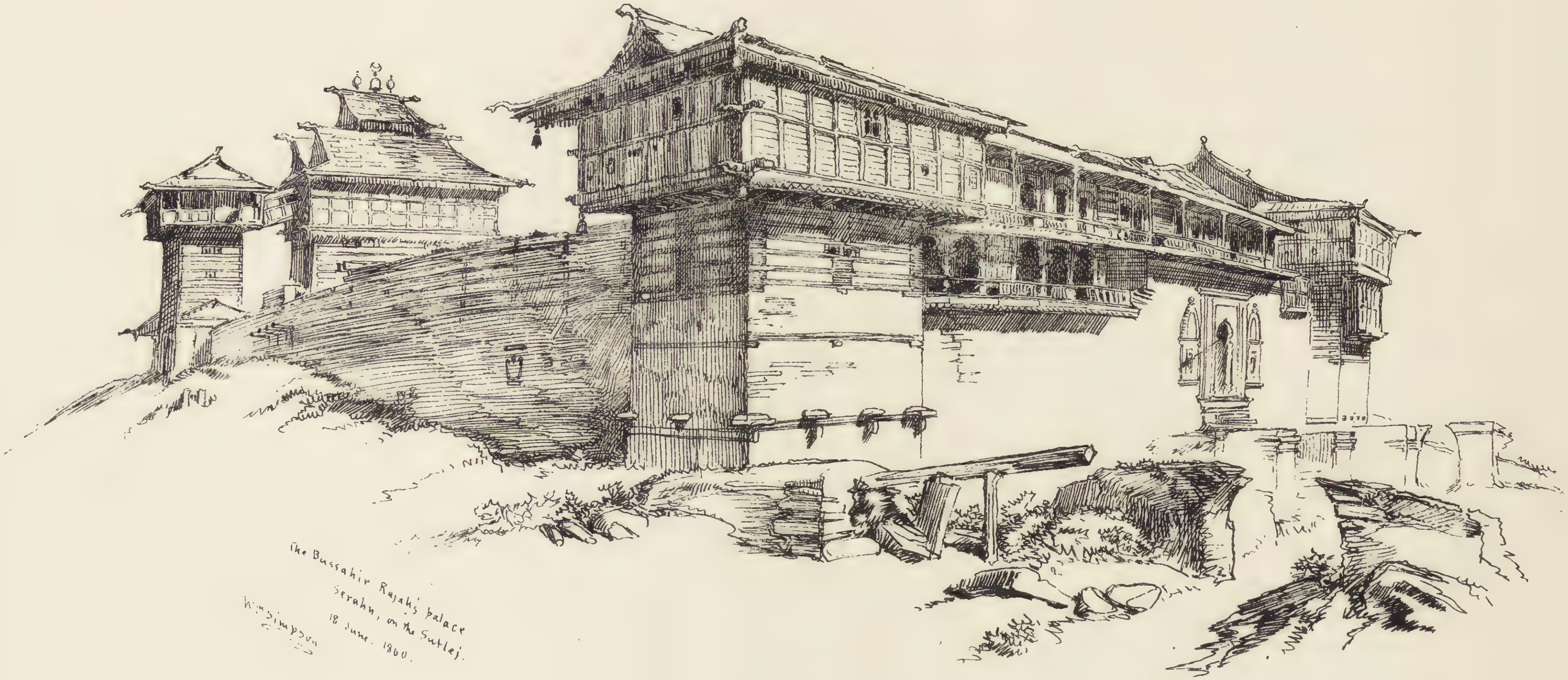


FIG. 81, PALACE AT SERAHN ON THE SUTLEJ.

J.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

VI. ARCHITECTURE IN THE HIMALAYAS (XXIX)

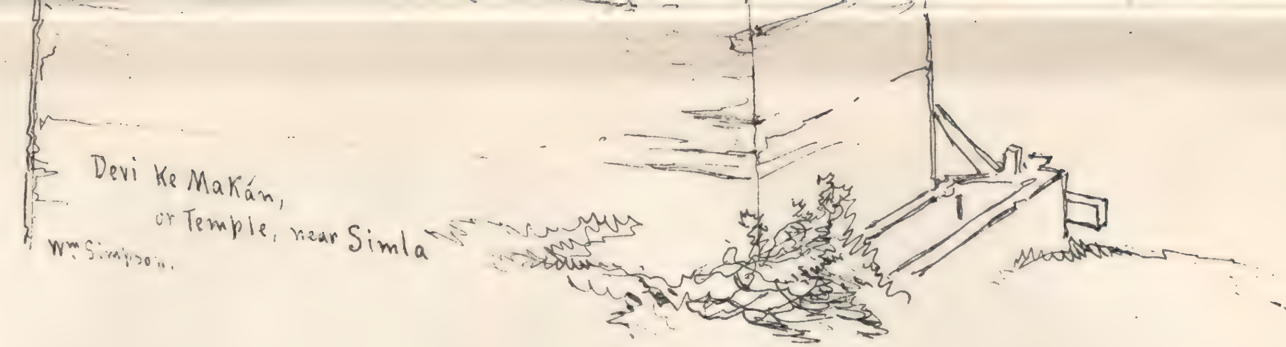


FIG 82, HIMALAYAN STYLE OF CONSTRUCTION.

FIG. 83, CIRCULAR ROOFS.

C.F.Kell, Photo-Litho. Castle St. Holborn, London, E.C.

VI. ARCHITECTURE IN THE HIMALAYAS (XXX).

FIG. 84.

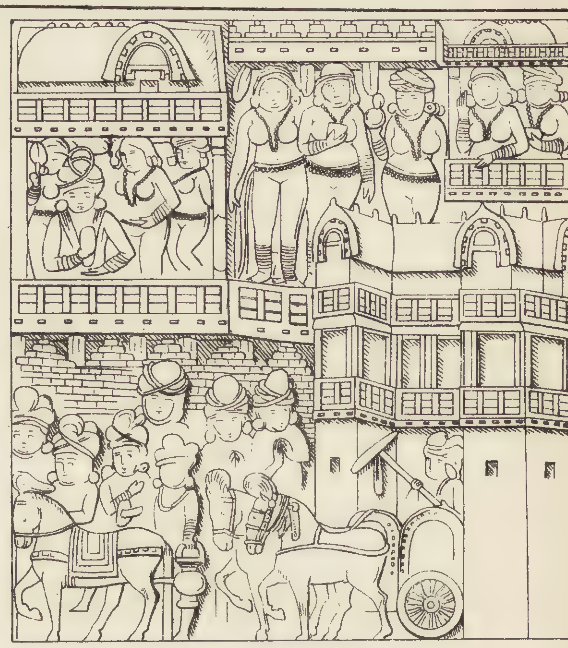


FIG. 85.

FIG. 86.

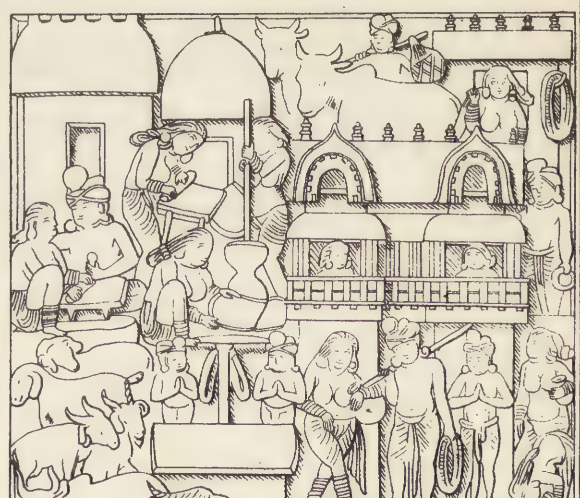


FIG. 87.

SCULPTURES ON THE GATEWAY OF THE SANCHI TOPE, B.C. 250.

(FROM FERGUSSON'S "TREE AND SERPENT WORSHIP.")

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

VI ARCHITECTURE IN THE HIMALAYAS (XXXI)

FIG. 88, DHARMSALAH AND TEMPLE, AT CHINI, ON THE SUTLEJ.

C. F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

VI. ARCHITECTURE IN THE HIMALAYAS (XXXII)

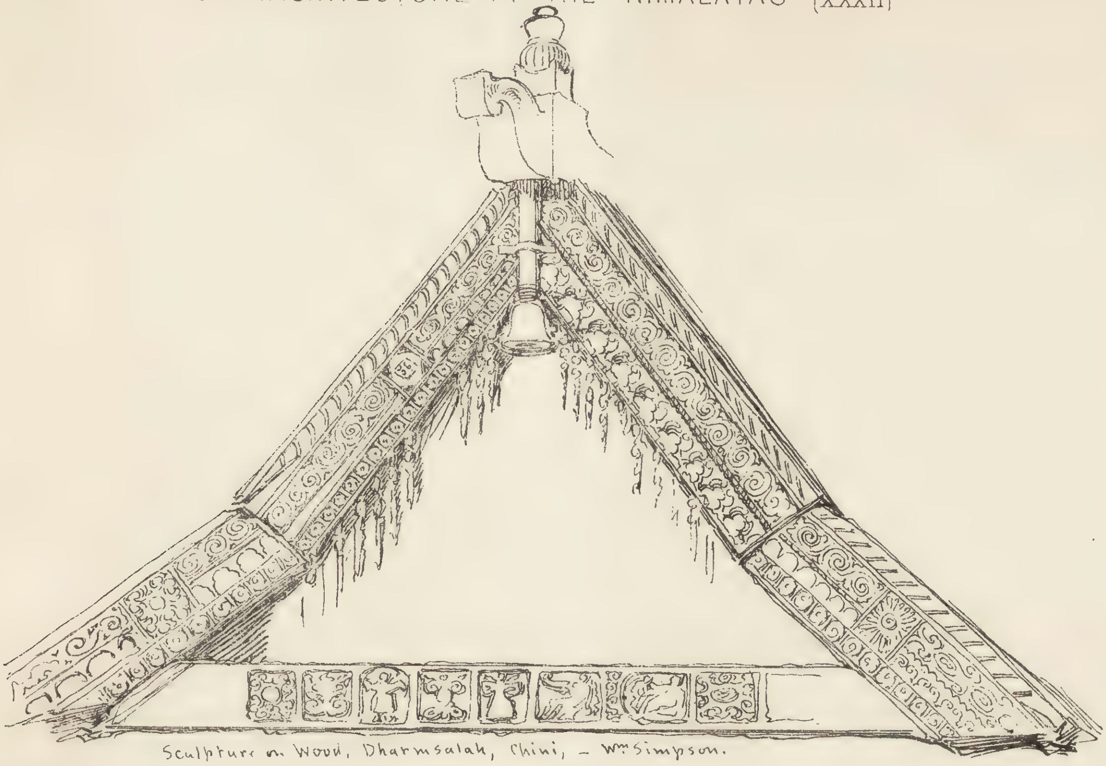


FIG. 90. SCULPTURE ON WOOD, DHARMSALAH, CHINI.

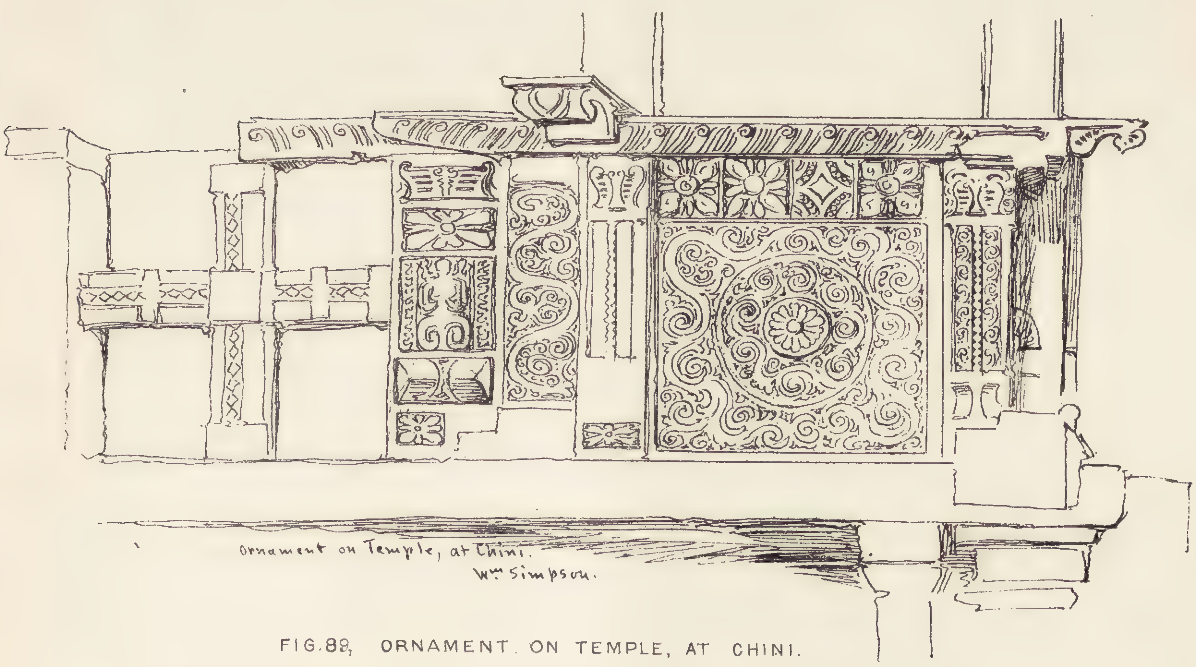


FIG. 89, ORNAMENT ON TEMPLE, AT CHINI.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

VI. ARCHITECTURE IN THE HIMALAYAS (XXXiii)

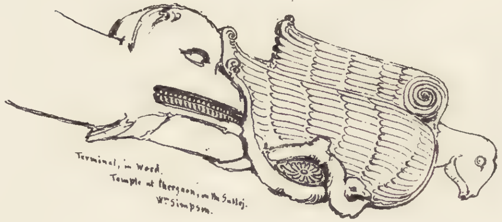


FIG. 91A

FIG. 91, TEMPLE AT CHERGAON, ON THE SUTLEJ

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

VI. ARCHITECTURE IN THE HIMALAYAS (XXXIV)

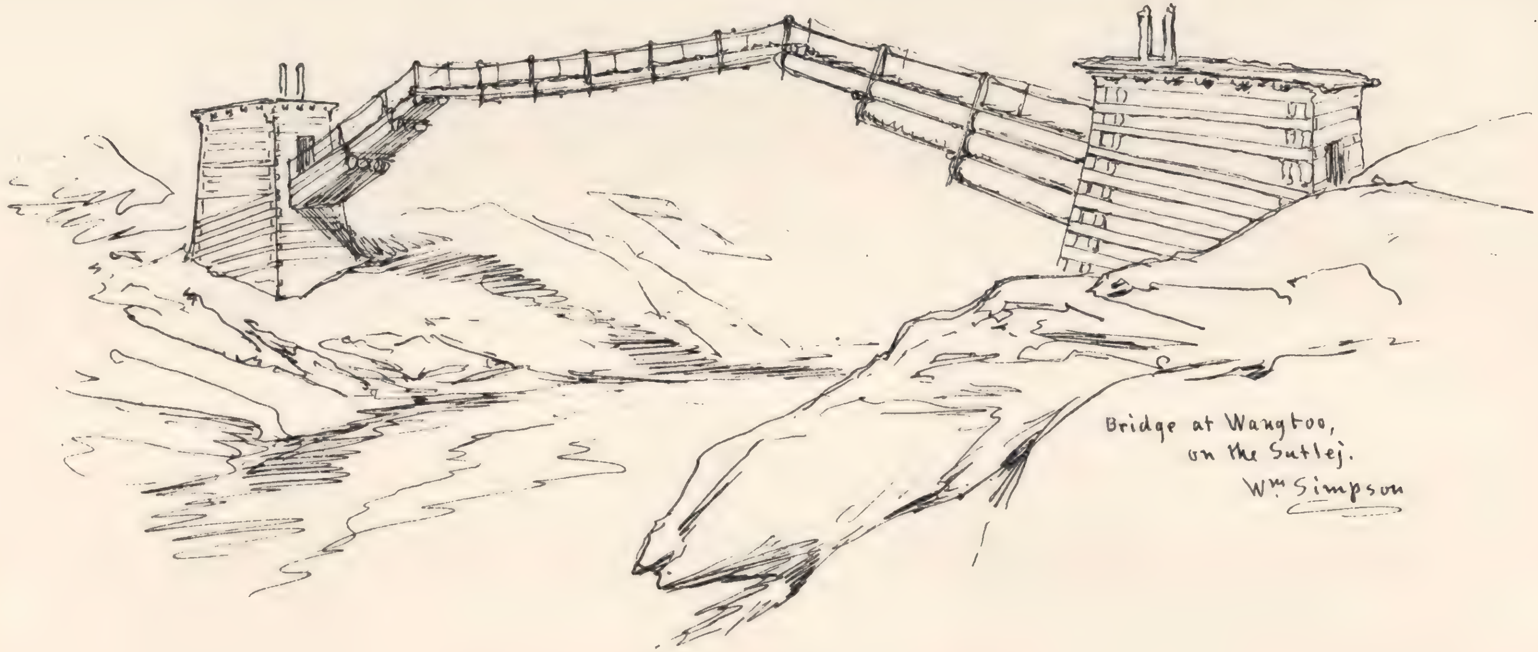


FIG. 92, NATIVE BRIDGE ON THE HINDUSTAN AND THIBET ROAD

F:G.93. A BRIDGE IN KASHMIR

C.F.Kell, Photo-Litho. Castle St Holborn, London, E.C.

FIG. 94. A CHARACTERISTIC HIMALAYAN BRIDGE.

VI. ARCHITECTURE IN THE HIMALAYAS (XXXV)

FIG. 95, _ THIBETAN HOUSES.

C.F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION.

By Edward C. Robins, F.S.A., *Fellow*.

[Read on Monday, 5th February 1883, Edward I'Anson, F.G.S., *Vice-President*, in the Chair.]

THE distinctive character of our times, according to Professor Huxley, lies in the constantly increasing part which is played by natural as contrasted with classical knowledge. The study of the natural sciences hitherto relegated to the "modern side" is rapidly being included in the curriculum of every liberal education. The application of the principles of physical science to the development of mental activity, as well as to industrial enterprize, will in all probability be the distinguishing peculiarity of educational progress during the remainder of this century, that is to say, the study of things themselves, and not only their names, is destined to accompany where it does not supersede the study of language and general literature as a mental exercise. So great a revolution in the system of education points to a corresponding change in the design of the buildings required for its development, and thus gives the *raison d'être* for the subject of this Paper.

My chief claim to the honour of addressing the Institute upon technical educational buildings is that I have visited the principal English and Foreign examples—in the former case accompanied by Professor Armstrong, and in the latter by both Professors Armstrong and Ayrton—who were instructed by the Guilds Institute to inspect the various *Polytechnica* of the German-speaking countries of Europe, prior to finally determining the fittings and apparatus which should be adopted at the Finsbury Technical College.*

Before proceeding with detailed descriptions it will be desirable to give attention to certain general principles underlying or rather governing the planning of technical buildings. I am not aware that any attempt has been made to formulate them, at least in my own case I found it necessary to collect the data from original sources in order to frame a system.† All technical education does not need special accommodation. The ordinary class-rooms attached to school buildings may be appropriated to certain kinds of technical instruction, provided they are efficiently lighted and ventilated. But there are many subjects which should be taught in specially-designed buildings, for example: chemistry and physics, biology and physiology, botany and forestry, mechanics and engineering, anatomy, architecture and the fine arts generally, and others involving the provision of laboratories, lecture-rooms, work-rooms, drawing-rooms, modelling-rooms, &c., separately grouped in a certain order and

* Some three or four years ago when occupying the Chair as Prime Warden of the Dyers' Company, I induced that Company to give its support to the City and Guilds of London Institute for the advancement of technical education, which led to my election to serve on the executive committee of that body; and last May (1882) I delivered a lecture at the Society of Arts on "English and Foreign Technical Education," to the Journal of which Society I must refer the Institute for my own general opinions on this subject. I have thereby cleared the way for this Paper, treating on the kind of buildings which will in future be required. In the lecture referred-to I gave no illustrations of buildings, but confined myself to the general description of prevailing systems of scientific education on the Continent, and contrasted them with our own, especially noting the extent to which strictly-technical subjects are included in the curriculum of each.—E. C. R.

† The Dictionary of the Architectural Publication Society contains a review of Professor Hofmann's report, made in 1866, on the Chemical Laboratories of Bonn and Berlin, then just completed.—E. C. R.

contiguity, specially floored, lighted, heated and ventilated, and arranged for particular furniture, fittings and apparatus—not to speak of the specific trade-schools for teaching weaving, dyeing, &c., &c.

In the older continental polytechnic institutions, as at Zurich and Vienna, all these subjects are taught in different departments of one and the same building; and where the technical education attempted is limited in extent, the same arrangement suffices. Special technological research has, however, necessitated extensions in this direction; and at Zurich, Karlsruhe and elsewhere, new and detached buildings have been added to the old foundations for technological and agricultural chemistry, botany and forestry. The great universities of the continent have also found it necessary to extend the laboratory accommodation, and to provide distinct buildings, which are erected in the neighbourhood. Thus, at Berlin, Professor Helmholtz's physical laboratory and its associated class-rooms and lecture-rooms are in one grand building; and Professor Dubois-Reymond's physiological laboratory is in an adjoining building—worthy companions of the handsome structure erected for Professor Hofmann so long ago as 1865. At Leipzic is a street full of separate and distinct buildings for these subjects, supplementing the old university provisions, which, however, are very good. At Geneva, Professor Græbe has designed and superintended the general arrangement and fittings of the new chemica laboratory, also situated apart from the university proper. Professors von Pebal and Toepler at Graz, Professor Landolt at Aachen and Berlin, Professor Bæyer at Munich, have each worked-out, with the respective architects, the details of their new and remarkably well fitted laboratories. At Strassburg the new university, which will be of a remarkably complete character, is being constructed in separate blocks. In addition to the main building for classical studies and general literature, distinct blocks are arranged for chemistry, physics, botany and forestry, mineralogy, &c., each block costing from thirty to forty thousand pounds, built in the classic style, faced with stone from the Harz mountains, and together covering several acres of ground. At Vienna the great university buildings in course of erection are similarly complete and extensive.

The study of the natural sciences abroad has become so popular that there is scarcely any educational centre that cannot boast of some magnificent addition to its public buildings for scientific instruction within the last decade. It is not surprizing, therefore, that this country should feel the same impulse, and that imposing structures should now be in demand in all our leading towns, some of which are already supplied by private benevolence or corporate funds, and in the case of Nottingham out of the municipal exchequer. The Science and Art Department at South Kensington is now too well known and appreciated to need any further reference. At University College, London, great additions have been made for the accommodation of applied science classes. Thus, besides the Slade School of Fine Art opened in 1871, new departments have been provided-for since 1878, viz.: zoology, comparative anatomy, physiology, technological chemistry, and an admirable engineering school.

To proceed to details: It is desirable in the first place to note the particular accommodation required for some of the leading special subjects,* number and relative position of the apartments,

* With regard to the accommodation required for the development of chemistry, physics and mechanics, a general statement will be found in the unpublished Reports of Professor Armstrong and Professor Ayrton, to whom in 1879 was referred the question as to what was the least provision they would think fitting for the

in short, the systematic general arrangement of the plan. In the arrangement of chemical laboratories,* the central points of interest are the main laboratory and the lecture-rooms; in the former the working-benches are required to be provided for each student, with convenient access to a sufficient number of sinks and draught-closets, both on the benches themselves and around the walls. The junior students or students of qualitative chemistry sometimes occupy different parts of the same main laboratory with the senior students or students of quantitative chemistry; and sometimes, as at Owen's College and most of the continental laboratories, they are provided with separate laboratories, in all cases overlooked from the demonstrator's raised operating-bench. In the generality of cases the students can all see each other and be supervized from the demonstrator's platform, but in some few cases, as at University College, London, they are so arranged that each student may be as far as possible separated from his neighbour, and from general supervision as a consequence. In all cases it is important that the re-agent store, the demonstrator's room, the special operating-room, and the balance-room should be in close proximity to and of easy access from the main laboratory or laboratories; their exact position varies, but on no account should any of the subordinate rooms form a passage to other rooms. Professor Hofmann's building in Berlin is defective in this respect, for the balance-room forms a passage between the two laboratories, and the delicate scales and weighing-apparatus are subject to the vibration and disturbance of passers to and fro. Professor Helmholtz's building is spoilt by the glazed passages formed on either side of his lecture-room, and when his assistant was taking Dr. Armstrong and myself over the building, we were cautioned to go on tiptoe to avoid disturbing the Professor, who was at that moment engaged in lecturing to a large class.

The lecture-room should always have a preparation-room adjoining the professor's end of the room, so that the preparation of examples and apparatus may be close at hand, and may be passed through the door, or the large glazed draught-closet immediately behind him, about 6 feet wide, 4 feet 6 inches high, 3 feet from the floor and 3 feet deep, the sashes provided being on each side of the closet. It is important that the lecture-room should also be in easy communication with the collections of models, apparatus and examples required by the lecturer. The position of the lecture-room should be such that no interruption of the lecturer may take place. The students' entrances should be at the upper end, farthest from the professor's table; his own end of the room should have doors of access to the corridor through the preparation-room and ante-room. There are numerous practical questions with which it is necessary to be familiar in order to avoid mistakes. Many thousands of pounds have been wastefully expended by architects who have only sought to meet the wishes of an irresponsible committee and have not been associated with the professor, whose appointment in one case known to me was not made till irretrievable mischief had been done. At the new Polytechnic in Dresden the Professor of Physics was contemplating the removal of his department owing to the vibration caused by the traffic in the street on that side of the building in which his department was placed. Delicate operations require the steadiest site. In the same way the special ventilation for chemical laboratories requires

purposes of the Finsbury Technical College or Trade-School then about being erected by the City and Guilds Technical Institute, and since completed.—E. C. R.

* See the sections of a large laboratory at Munich in Illustn. xxxvii.

both common-sense and care, for many otherwise admirable systems have failed in consequence of the neglect of obvious requirements—till too late to amend them—chiefly arising from the want of a complete understanding between the architect and the ventilating engineer or the professor himself. Professor Græbe, of Geneva, stated that all his room ventilation at his chemical laboratory was effected through the draught-closets, no use being made of the general room-ventilating exit-openings leading to the base of the furnace-shaft; this latter in fact was a failure so far as the chemical laboratory was concerned, the greater *pull* being through the draught-closets, the air of which was sucked-out by the fan fixed at the entry of the collecting channels, at the level of the roof, into the side of the great exhaust-shaft, within which was the iron chimney-flue from the furnace. A similar result followed the otherwise excellent ventilating arrangements at Munich, Aachen and elsewhere. In every case in which no special mechanical system was employed, the ventilation was practically nil, and in some cases, as at the comparatively old Polytechnics of Zurich and Vienna, was excessively bad.

The *Foreign Buildings* to which I venture to draw attention are the following:—*

1. Professor Hofmann's Chemical Laboratories at the Universities of Bonn and Berlin.
2. Professor Bæyer's Chemical Laboratory, Munich University [Illustns. xxxvi, xxxvii].
3. Professor Dubois-Reymond's Physiological Laboratory, Berlin [Illustn. xxxviii].
4. Professor Landolt's Chemical Laboratory, Aachen.
5. Professors von Pebal's and Toepler's Chemical Laboratory, University of Graz.
6. Professor Weinhold's Physical and Chemical Laboratory, Royal Trade School, Chemnitz.
7. Professor Kohlrausch's Physical Laboratory, Würzburg.
8. The Technical High School, Hanover.
9. The Royal Technical High School at Stockholm, Sweden.
10. The Chalmers Industrial and Technological School, Gothenburg, Sweden.

The *English Buildings* are the following:—

11. The Central Technical Institution, South Kensington, in course of erection by the City and Guilds of London Institute for the advancement of technical education [Illustns. xxxix-xliii].
12. The Yorkshire College, Leeds [Illustns. xliv, xlv].
13. The Technical College, Finsbury, erected by the City and Guilds of London Institute
14. The University College Additions, London.
15. Owen's College Laboratories, Manchester.
16. The Manchester Grammar School Laboratories.
17. The Mason College, Birmingham.
18. The Merchant Venturers' Trade and Mining School, Bristol [Illustn. xlvi].

The itinerary of my recent tour in Germany was as follows: In January 1882, I met Dr. Armstrong at Strassburg, whence we proceeded to Mülhausen and to Geneva, where Professor Ayrton joined us on his return from Algiers. From Geneva we proceeded to Zurich and thence

* Besides these, the grand Berlin Polytechnic, viz., the Fine Art and Building School at Charlottenburg, must be mentioned. The new college at Strassburg which I recently visited is also a most important work. In a paper read at the Society of Arts in April 1880, on "Secondary School Buildings," I described and illustrated the famous forerunner of English examples, viz., the Technical College at Japan.

to Munich; from Munich to Vienna, whence Dr. Armstrong went on to Graz and Buda-Pesth, while Professor Ayrton and I proceeded to Dresden and Chemnitz. The Professor took Würzburg on his road home, while I returned to Dresden to meet Dr. Armstrong. We then together pushed on to Leipzic, Berlin and Aachen, whence I returned home after a month's absence. In all these places we visited the University Science Buildings and the *Polytechnica,* as well as other buildings of lower grade.

Foreign Buildings.

1. The Chemical Laboratories of Bonn and Berlin.—One of the earliest laboratories is that at Bonn, beautifully situated in a park in the outskirts of the town, and erected some twenty years ago at a cost of £20,000. Almost simultaneously the Berlin laboratory was carried-out at a cost of £32,000. Both the examples serve to illustrate the remarks of Professor von Pebal.* At Bonn, the arrangements are confined to one floor, at Berlin to

* It will be appropriate to quote the opinions of Dr. von Pebal, of the Chemical Institute at Graz, whose remarks on the planning of chemical laboratories are exceedingly valuable. He tells us that no scientific institution requires the fulfilment of so many and such various conditions in its design and arrangements as a chemical laboratory, and the difficulties arising out of this increase considerably with the number of students for whom practical instruction must be provided. The greater the number of individuals working simultaneously in a laboratory, the more necessary is it to isolate work of different kinds into separate rooms, in order to avoid mutual disturbance. Not only the size, but also the number of rooms requisite, must be increased for a larger number of students; this, however, unavoidably entails additional distances, and the consequent disadvantages, viz.: loss of time, fatigue, and the difficulty of superintendence. After discussing various forms of plan, Dr. von Pebal comes to the conclusion that an arrangement of the rooms round inclosed yards answers the best to the need of short distances and light rooms, and in order to avoid a great expanse or area of building, the rooms must of necessity be in storeys one above another. The arrangement and relative size of the rooms in the building depend essentially upon the principle and the dimension according to which the above-mentioned division of groups is designed. In most laboratories the beginners are in separate rooms from the advanced students, or if the principle of separation is based on the different kind of work, the qualitative is separated from quantitative analysis, and again both of these from the organic chemistry department. In the Chemical Institute at Pesth, close to a large laboratory for beginners, are several small rooms, arranged as laboratories for from two to six advanced students. Each of these ways of separation has its own peculiar advantages; it is specially convenient for those who are engaged in independent scientific researches to have to share a room with a small number only, so that they can either make use of apparatus for any length of time or leave it standing unused according as required. The erection of special qualitative and quantitative laboratories appeared to Dr. von Pebal to be less worthy of imitation, because he considered it desirable for several reasons to give beginners practice in qualitative analysis simultaneously with simple quantitative methods. The incitement to work which a laboratory offers is proportionate to the varied character of the work which is carried-on in it. Improved planning and arrangement, as well as good methods of ventilation and sufficient superintendence, have tended to lessen the difficulties of carrying-out different kinds of researches at the same time and place. For this reason it is best to limit the number of these departments to two, each of which should be furnished with the most complete arrangements possible. Complete independence in the distribution of the working-places is thus preserved, which renders it unnecessary to over-crowd one department and leave the other almost unused. The necessary working space can be made to answer to the requirements of the students by placing half a working-table at the disposal of beginners, and a whole one at that of advanced students. For operations which require a large amount of room and which cannot be performed at each working-place, there must be certain spaces of which the necessary arrangements are at the disposal of each practical student. A university laboratory, however, cannot be expected to take the place of a chemical manufactory, either as regards the necessary appliances for the preparation of large quantities of chemical substances or the learning of methods of manufacture, though modern progress in technical education is tending in that direction—witness the numerous specially-technological institutions which have lately supplemented the older pure science colleges abroad—nevertheless, even in purely scientific researches it not unfrequently happens that large quantities of substances have to be dealt-with, and it is indispensable that

two, both having lofty basements. At Bonn the building has wide corridors surrounding and overlooking the great central quadrangle, in the middle of which is the large lecture-hall; while that of Berlin being a town building and surrounded by buildings has no such corridor, and is so arranged that the rooms are made passages, and even the balance-room is not sacred.

At both Bonn and Berlin the basement gives accommodation for store-rooms for dry solid and liquid re-agents, for large stores of glass and porcelain, for washing and for heating and ventilating arrangements. Laboratories for physiological chemistry, accommodation for the medico-legal investigations, and for animals undergoing chemico-physiological treatment, are also provided at Bonn, and at both, workshops, fuel and other stores are provided.

At Bonn, the basement, being more extensive, contains apartments which at Berlin are at the level of the ground, as furnaces for assaying, smelting, &c., with flues 60 feet in height, to insure good natural draught; also specially-arched niches, let into the walls and provided with inclosing iron doors, for the protection of the manipulator when experimenting with substances at high temperature in sealed tubes. At Bonn the ground-floor comprizes spacious vestibules and corridors. The front and southern block is devoted to scientific collections, mineralogical and chemical museums, and a small lecture-theatre for special subjects; the east wing is appropriated to the assistants, and the west wing to the private laboratory, &c., of the director. The great central hall for 250 students is 40 feet square and 28 feet high (that at Berlin is 37 feet high, but it would have been wiser in the latter case to have reduced the height and to have descended to the basement to it, so that the light to the rooms around might have been less obstructed). In close proximity to the lecture-hall is the lecturer's assistant's or preparation-room, then rooms for apparatus, models, diagrams, &c., the Professor's room, cabinets, &c. The two northern quadrangles on the right are surrounded with buildings devoted to practical instruction in chemical analysis and research; there are three laboratories each 54 feet by 22 feet, by 17 feet high, and fitted for twenty students each, or more in the junior classes. The first is for beginners, the second for advanced students, and the third for young chemists engaged in original experimental investigations. At the northern end of the laboratories are three operation-rooms communicating with each other, and by open covered colonnades. The remaining rooms are appropriated to volumetrical analysis; two balance-rooms, for balances, air-pumps, barometers and other delicate physical apparatus; two rooms for fusions and ignitions, a library, laboratory for gas analysis and photometric room. Professor Thorpe, who was a student there, tells me that the distances were too great and that the journey to the balance-rooms was postponed as long as possible, thereby confirming Professor von Pebal's injunction.

At Berlin the plan is more compact, but is full of defects, which have been overcome in later laboratories, and it is now regarded as by no means an example to be imitated even by Berliners. There are two large laboratories at Berlin, 48 feet by 31 feet wide, for twenty-four students each, divided by a preparation-room, 32 feet by 20 feet, and a third laboratory,

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young experimental chemists (especially pharmaceutical chemists) should be practised in the manufacture of preparations, and in putting together and handling the most ordinary apparatus and appliances; consequently there should be particular rooms for this purpose, in the arrangement of which special provision must be made for the requisite number of flues.—E. C. R.

47 feet by 24 feet, for sixteen students engaged in original research, with a combustion-room attached. The open colonnades on the ground floor carry galleries, that on the right being for the beginners' laboratory and the library; that on the left is in three portions, the two ends being for fusions and ignitions for the second and third laboratories respectively, the balances being in the centre between them, a defect already noticed and brought home to me by an accident which occurred as I was passing. The fire ran along upon the ground of the balance-room, and though speedily extinguished proved the danger of making the subsidiary rooms passages between the main laboratories.

2. The Academy of Sciences, Munich.*—I propose to treat rather fully of the new chemical laboratories at the Academy of Munich, because the building is one of the best examples of modern German work. The building is cellared throughout, and consists of a ground and first floor [Illustn. xxxvi, figs. 96, 97]; the basement [fig. 98] is used for store-rooms, work-rooms, furnace-rooms, &c.

The ground floor is for the organic and the first floor for the inorganic divisions. The central point of the separate large laboratories, of which there are two on each floor, is occupied by the big chimney, which is placed in the internal angle between the north and west wings, which are at right angles with each other. At the ends of both wings on both floors are the two large work-rooms or laboratories; and from the connecting corridors between them access is given to the subsidiary rooms. A hoist near the chimney communicates with the store-rooms. At the end of each wing of the separate laboratories are buildings. That on the south-west is the servants' dwelling-house; that on the north-east contains the two private laboratories. A better position, I think, for the professor's private work-rooms would have been to the north of the western wing, so as to be as central as possible between the students' work-rooms, but the exigencies of the site necessitated otherwise. A grand staircase was not provided, but two smaller ones are at either end of each wing. The first serves as a staircase for the servants' house as well as the students' western laboratories; the second connects the private laboratories and the general collections with the students' northern laboratory. The students' entrances are at or near these staircases, passing the vestibules, opening into which are cloak-rooms and retiring-rooms. The sole distance which the students have to go during work consists of the short walk to the special rooms in the corridor. If they wish to cross from the western to the northern laboratory, or to the basement or first floor, they can do so by using the staircase without making a thoroughfare of the laboratories. There is a small service-staircase placed next the big chimney, and a hoist and a servants' store-room are

* In 1875 Professor Bæyer was commissioned to prepare the plans for a new chemical laboratory, in which he was associated with Professor Albert Geul, architect. In 1880 they published a pamphlet describing the same, and from this I have supplemented the information I obtained during my visit with Professors Armstrong and Ayrton. In dividing the plan the following points have had to be considered: 1, The laboratory must accommodate from 150 to 200 workers; 2, It must be divided into two spacious parts, one for inorganic and the other for organic chemistry, each to be under separate direction; 3, The director of each portion must have a private laboratory with the necessary extra rooms, the assistants to work in the large laboratories; 4, The main laboratories must be sufficiently spacious, smaller rooms for advanced students *not* to be provided, in order to promote the intercourse of the workers, corridors as far as possible to be avoided; 5, Living-rooms in connection with the building must be provided for the assistants and servants. The old laboratory and lecture room of Liebig forming the central block, and erected in 1852 by Liebig, were to be incorporated in the new building.—E. C. R.

provided. The staircases are of stone, and the basement and ground floors are arched over. The large lecture-hall is entered from without by two students' staircases; behind the professor's table is the glazed chamber opening to corridor, through which apparatus is passed-in from the preparation-room. A small theatre is situated on the other side of corridor. Beyond the preparation-room is the room for collections, over which is a similar room. The relative positions of these rooms are not so good as at Aachen, resulting from the adaptation of the old Liebig buildings. From the lecture-room is a corridor connecting it with the detached dwelling house of the professor. The main court yard is entered from the Sophien-strasse, between the servants' dwelling-house and the large lecture-room; it is inclosed on the west and north by the large laboratories. It is the thoroughfare to the three flights of entrance steps, and for carriages, carts, &c.

Now as to the internal arrangements [Illustns. xxxvi, xxxvii]:—

The Laboratories for the Organic Division, Ground Floor [fig. 97], are fitted alike, but in Laboratory II [fig. 97], which is for beginners, each table is intended for two students, whereas in Laboratory I [fig. 97], which is for advanced students, a whole table is assigned to one, accommodating thirty-two students in the former and sixteen in the latter. The floors for the sake of warmth are made of wood, with an asphalte border round, 3 feet wide, on which stand the wooden sinks and digestoriums or draught-closets. In the middle of this border is an asphalte gutter-channel; this gutter is trapped at the two opposite ends, and communicates with the main drain. This channel carries away the wastes from sinks and draught-chambers, and also any floor-droppings, being covered only with perforated boards. This arrangement is said to work well in practice, and allows of carrying on large operations in the immediate neighbourhood of the work-tables; the central avenue being the general thoroughfare.

The Laboratories III *and* IV *for the Inorganic Division, First Floor* [fig. 96], are similar to the former. In each room there are ten double tables, each with three working places on a side, so that there is accommodation for sixty workers in each room, about 3 feet being given to each.

The Subsidiary Rooms to the Organic Division, Ground Floor.—*a*, a room for heating sealed tubes, called the cannon room; *b*, glass-blowing room; *c*, small combustion room; *d*, preparations or specimen room; *e*, washing-up room, in which is the hoist, and it serves as a work-room for laboratory servants; *f*, large combustion room; *g* and *h*, balance rooms; *i*, stink chamber. Passing to the private laboratory block we come to the following subsidiary rooms:—*k*, library for the use of students; *l*, consulting room; *m*, professor's balance room; *n*, air-pump and blowpipe room; *o*, specimen room; *p*, washing-up and stink chamber; *q*, the private laboratory, which is at end of corridor. In addition to the work tables there is a hearth for combustions. There are also draught-closets, the ventilation being effected by gas flames in the private laboratory, owing to its distance from the chimney-shaft.

The Subsidiary Rooms to the Inorganic Division, First Floor.—*r*, filtration room; *s*, blowpipe room; *t*, smelting and air bath room; *u*, specimen room; *v*, washing-up and servants' room; *w*, stink chamber; *x* and *y*, balance rooms; *z*, sulphuretted-hydrogen room. In the private laboratory are the following subsidiary rooms:—*a a*,

physical cabinet; *b b*, consulting room; *c c*, balance room; *d d* and *e e*, gas rooms; *ff*, washing-up room, with smelting furnace, &c.; *g g*, the second private laboratory.

The main building is heated by steam. The heating surfaces consist partly of chests, partly of coils. The steam is generated in two large boilers, contained in the boiler-house placed in the courtyard. The servants' house is heated by stoves; the director's house by hot water; the lecture-rooms by coils with two small stoves, in addition to the large lecture-room. In the laboratories are four stoves and two small coils.

The ventilation of the main laboratories is now effected by ascending flues from the draught-closets, sixteen in number. The laboratories are also connected with the general ventilating system, with descending extract-flues as shown in section [Illustn. xxxvii, figs. 99, 100], but these are no longer used, as they were found to interfere with the ventilation of the draught-places. Experience has shown that the rooms are sufficiently ventilated, provided that all noisome operations are carried-on in the draught-places, fresh air being admitted very generally. The air as it enters the laboratory is led through short channels round the four stoves. The sixteen draught-closets are connected by means of glazed earthenware pipes with horizontal canals leading to a space in the roof through which runs the big chimney, and with which this space is put into direct connection. The draught up the chimney from the steam-boilers is sufficient in winter to work the arrangement; in summer it is necessary to urge it by means of a fan worked by a small steam-engine in the basement. The same arrangement serves to ventilate in addition the sulphuretted-hydrogen-room and the stink-closets. The horizontal canals or channels, as well as the chamber with which they are connected, are made of bricks joined with asphalte and lined internally with the same material. The steam-boilers not only supply steam for heating, but also, by a special service, for the drying-closets and the distilling apparatus. They also work a pump and the fan which sucks-out the foul air from the basement channels with which the descending flues are connected.

3. The Physiological Institute, Berlin.—Through the kindness of Professor Lewis, who has lately made inquiries for me at Berlin, I am enabled to give plans [Illustn. xxxviii, figs. 101-104] of the new Physiological Institute at Berlin, which adjoins Professor Helmholtz's physical laboratory, and is in some respects explanatory of it, at least so far as the lecture-hall is concerned. It will serve as a good example of the manner in which these buildings are constructed, with the aid of government grants, by architects appointed by government, and usually themselves professors of architecture in one or other of the technical colleges. In this building the arrangement of the galleries of the hall is suitable enough because they communicate with the hall alone; but in the physical laboratory adjoining, similar galleries are made the means of access to rooms beyond the hall, and consequently, though the gallery-openings are glazed, traversing to and fro arrests the attention of both speaker and audience, which defect I noted in my previous remarks.

4. The Chemical Laboratory, Aachen.—The buildings at Munich, Aachen, Graz and Leipsic are examples of modern German chemical laboratories, as late as 1879 and 1880; and they each teach the same sound lesson, only in different ways suited to the peculiarities of the circumstances and the character of its director. Professor Landolt's building at Aachen is replete with every scientific convenience, and is of all others an example of successful heating

and ventilation. The fresh warm air is forced-in by a fan, and the foul air is sucked-out by two fans, without any conflict in the action: the *push* and *pull* principle pure and simple; and the whole is under the control of the engineer, who has an electrical tell-tale dial arrangement by which he can know the temperature of every important room in the building, and appliances to enable him to "temper the wind" when necessary. The arrangement of the plan is good, if we except the front corridors, which are vaulted and sumptuously painted, and as a matter of fact are more ornamental than useful.

The subsidiary rooms to the lecture-hall are admirably grouped around it. The fine balance-room lies between this group and that of the quantitative laboratory, with which it directly communicates; organic chemistry, special operations, gas analysis, &c. are in the right wing, and in the left are the qualitative rooms and the small lecture-room. The laboratories are single-storey buildings in this case, and are lighted from the roof as well as the sides. It is a costly erection faced with stone, and the theatrical effect of the interior of the lecture-hall is extremely good.

5. The Imperial University of Graz.—The Chemical Institute at this university, begun in 1874, was not completed till 1879. Professor von Pebal published an account of it in 1880, from which my information is derived. It is economically built of brick, with plaster dressings internally and externally. The floors of the rooms are either of asphalte, cement, or deal as required. Great care has been taken in all that relates to the efficient working of the institution, as the construction of working-tables, draught-niches and places—experimental trials being first made—and the total cost was upwards of £50,000. The fresh air is forced-in by fans through five distinct steam-heated heating chambers, and the air is changed three times in the hour. The *push* principle, pure and simple, is adapted here without conflicting draughts. The entrance vestibule and great corridor is a decided improvement on Aachen. The residences occupy the right wing; the lecture-hall the central block, and the laboratories the left wing. The subsidiary rooms in connection with the lecture-hall consist of the professor's retiring-room and private corridor to front hall; the preparation-room, and two rooms for collections. The students have a fine ante-room for hats and coats, giving access to the upper part of the lecture-hall. The subsidiary rooms in connection with the laboratory are arranged at both ends of it, but the opposite doors opening into the spaces between the benches and the draught-closets, leads to making a thoroughfare of what at Munich is so much more usefully added to the working space. Nor do I think that the arrangement of this room, with a working-bench in each window, besides the central rows of double benches, is an improvement on the Munich plan of putting the draught-closets in the windows, and the sinks against the piers between, although the accommodation may be relatively greater.

6. The Royal Trade School, Chemnitz.—The town of Chemnitz in Saxony has recently been brought into prominent notice, through the publication of Mr. Felkin's pamphlet upon the educational advantages of a technical character which it possesses. It has no university, it has not even a polytechnic, so called, but it is full of High schools for general and special education, and is especially strong in Trade schools. I select for illustration the Royal Trade School, comprizing the *Gewerbschule*, the *Werkmeisterschule*, and the *Baugewerkenschule* for artizans, which I visited with Professor Ayrton. The grand staircase is opposite the main entrance. The chief corridor runs right and left, and returns at right angles in both wings,

but except in the basement the wing corridors are utilized as rooms. Left of the staircase on the ground floor is the chemical store-room, and the general chemical collection is next to it. The chemical laboratories for students in the first course of the Trade School occupy the whole of the left wing. The lecture-room adjoins, and the teacher's rooms are on either side of the main entrance. The room on the right is at disposal. The right wing is devoted to mineralogy; first the teacher's laboratory, next the mineralogical collection, then the lecture-room, a room for delicate work and a waiting-room, bring us round to the main staircase again, on either side of which are conveniences. Descending to the basement, and taking the same route, we come to the gasmetre-room and two store-rooms, and a galvanic battery-room. In the left wing is accommodation for furnace operations, for steam operations, and a mechanical workshop. Then come two rooms for fire operations, and under the main entrance a photometric room, the gas analysis-room, and the large fuel store-room, which is now used for physical experiments. The right wing is devoted to house-stores; the small room at the back, which is the pendulum-room, extends the whole height of the building, with a small gallery at each floor, where experiments in connection therewith are made. A similar pendulum-room or tower is provided in the central well of a circular staircase at the physics laboratory of the new University of Strassburg.

Ascending to the first floor we enter the technical chemistry collection. The left wing is devoted to the *werkmeister* or foreman's school, first a teacher's laboratory, next the students' laboratory, next an experiment-room, and last, a spectrum analysis-room. Adjoining the left wing in front is the lecture-room for technical chemistry, and there are three work-rooms for assistants and lecturers on physics. The remaining rooms are for the department of physics, first the lecture-room for physics, for students of the foreman's schools, with a preparation-room, between it and the lecture-room for physics, for students of the *Gewerbschule.* It will be observed here that the lecturer's table in each lecture-room has a portion which is made moveable, so that apparatus arranged thereon may be moved along the tramway to and fro, for the service of both classes of students. Professor Weinhold gives details of this table in his book. The other three rooms are occupied by physics-apparatus collections, without which no technical physics-teaching can be effective. The small room next the large lecture-room is used as a dark room for experiments on light, and being situated at the end of the long corridor, a ray of light may be thrown through the door the whole length thereof. The arrangements for darkening the lecture-rooms at the professor's will, the spectrometer, the vacuum process, and a variety of special arrangements for gas, water, quicksilver baths, steam-drying cylinders, electrical apparatus, &c. are far too numerous to mention. Professor Weinhold's perfect command of the English language enables him to give full information to Englishmen, and to no better place than Chemnitz could any student go to perfect himself in technical or applied science school requirements.

On the second floor of this building, starting from the left of the main staircase we come to a store-room, an apparatus-room, a work-room for the chemistry assistant, and a balance-room. The chemical laboratory of the students of the first and second course of the *Gewerbschule* occupies one side of the left wing, adjoining which is a room for elementary analysis, and a sulphuretted-hydrogen-room. The next front room is for general experiments by students as above, with a waiting-room adjoining. Then comes the balance and microscope

room, then the technical chemistry teacher's work-room. The rest of this floor, except the physics collection on the right of main staircase, is devoted to the teacher's apartments. This is an interesting example of the sort of building required at every industrial centre, for the development of elementary technical science and art among foremen and practical men generally.

7. The Physical Institute, Würzburg.—Professor Kohlrausch's Physical Institute is an interesting building, specially devoted to one purpose; and Professor Ayrton, who recently visited it, highly commended all its arrangements. The entrance to the principal floor is at the west end, the assistants' apartments are on the left of the entrance, and on the right is the passage to the lecture-hall, in communication with which are the preparation-room and two collections of apparatus, models, &c., between which is the staircase. The main corridor extends from west to east, from which seven laboratories are entered, and a third collection-room towards the north. Descending the staircase we reach a large hall, with exit to yard, next which is the engine-room, with a gas engine and electrodynamo; on the north side, communicating with each other, are two laboratories, fitted with stone tables, sinks, evaporating-closets, next to which is a store-room; there is also a lavatory with circular stairs to the floor over; a large work-room is at the east end, and next it a chemical-room; the heating-apparatus and coal-cellar adjoin, and a workshop, with forge and sink. The building is heated with hot air by flues, and the foul air is withdrawn by the furnace of the heating apparatus by descending channels. The remaining rooms are for servants' residence and domestic offices.

8. The Technical High School, Hanover.—This important, complete and well-appointed technical school consists of a cellar storey, a ground storey, the principal or first storey, the second and third storeys. It is designed in the palatial manner, which always distinguishes German educational buildings. There are five open courts inclosed in the ground plan of the building, which measures 500 feet long by 250 feet in depth. Flights of external and internal steps give access to the great corridor, 120 feet long by 20 feet wide, forming one side of the central quadrangle, which is entirely surrounded by wide corridors, and intersected in the middle by the two grand staircases, connected by the *foyer* on this floor. On the right of the chief entrance we find a passage to the chemistry and physics departments, a lecture-room and a preparation-room for analytical chemistry, a long hall for practical chemistry, divided by a room for ordinary operations. Passing up the corridor of the extreme right wing at right angles to the front we have the room for gas analysis, the library and balance-room, the instrument-room and the staircase to the next storey of this wing, which is entirely devoted to chemistry. The professor's private rooms and laboratory occupy the rooms over those last described; on the other side of the staircase to the left is the chemical manufacturers' collection. The lecture-room for technical chemistry, its preparation-room, and its chemical collection, follow, and beyond is an assistant's laboratory.

On the right are the collections of models or examples, and more assistant's rooms; opposite the end of the corridor is the entrance to the gallery of the examination-hall, and to the left is the large lecture-room for chemistry with its satellite the preparation-room. Descending the staircase to the floor below we enter the physics department; on the left of the corridor is the small lecture-room for physics, with its preparation-room and physics collection-rooms. The

whole of the rooms on the right side of the corridor are devoted to the physics work-rooms or class-rooms. The examination-hall is at the end of the corridor, and to the left is the large theatre for physics, with its preparation-room and professor's room. Returning to the main corridor and along the corridor of the right intermediate wing we pass the botanical and zoological collections, the housekeeper's room and the engineering lecture-room; at the end of this corridor to the right is the refreshment-room; turning to the left the whole of the remaining rooms in this front are devoted to the engineering classes, with a collection of drawings adjoining the professor's room in the centre, drawing class-rooms on either side, and a lecture-room for mathematics and mechanics, in all 330 feet in length. Returning to the left intermediate wing, and passing the engineer's waiting-room, the teacher's private room and sitting-room, and cloak-room, we come to the passage to the library, the reading-room, and the librarian's room. The remaining portion of this floor is given to the offices and the residence, the domestic offices being on the floor below. Ascending the rear main staircase we arrive in the midst of the drawing-rooms and lecture-rooms for architecture and building, divided into four classes of students; the professor's room and the collection are in the centre, and the lecture-rooms at each end. The left wing is occupied by a collection of models of building-construction, a lecture-room for technology, a professor's room, and large rooms for technological collections. Returning to the left intermediate wing we pass another lecture-room for second and third classes in building and architecture, and we come to the laboratory for geology and mineralogy; then the geological collections, the lecture-rooms for geology and mineralogy, the mineralogical collections, divided into two halls by the professor's room in the tower over the main entrance. The right intermediate wing contains two professor's rooms, a practical geometry class-room, a collection of mathematical instruments, and a lecture-room for practical geometry and mechanics. Proceeding up the rear or north grand staircase we arrive in the midst of the mechanics' department. The drawing class-rooms occupy the whole of the northern front, except the lecture-room for the mechanics students and teachers; a professor's room is at each end of the corridor. The western side of the quadrangle is the large room for the first building and geometrical drawing classes. The eastern side is entirely devoted to the mechanics collection. The southern side, with windows looking north, is the freehand drawing school, and the collections are on the southern side: three professor's rooms occupy the south-west angle. The ground floor is chiefly devoted to residences for the various officers, as the professors of chemistry and physics and their assistants; the workmaster and machinists, the housekeeper, the secretary, &c. &c. Under the library and reading-room is a vast room for technical experiments, and on the western side of the northern front, under the engineer's drawing school, is a second freehand drawing class-room. The important part which drawing takes in this institution is one of its most remarkable provisions. The basement contains the heating-apparatus and ventilating arrangements, and a series of cellars for the chemistry and physics departments is in the east wing.

9. The Royal Technical High School, Stockholm.—The earliest provision for technical education in Sweden was in 1809, when lectures were given to artizans privately in chemistry and physics. In 1813 the Mechanical School was founded at Stockholm; in 1822 the School of Mines; in 1825 the Royal Technological Institute; by 1860 £25,000 had been spent in new buildings, and £2,500 a year granted by the State. In 1866 the School of Mines was

incorporated with the Royal Technological Institute, and the whole denominated the Royal Technical High School; £6000 more capital was granted, and £1000 a year more income. In 1876 the department of architecture was instituted in addition to practical mechanics, mining science, and civil engineering. The High School possesses rich collections of models, instruments, &c., geological and mineralogical specimens; and a library of 18,000 vols., besides 95,000 English Patent Office reports. There are about 300 students, and the expenditure is some £10,000 a year.

10. The Chalmers Industrial School, Gothenburg.—Founded in 1829 with half the fortune of William Chalmers, of English parents, and a merchant of Gothenburg, this industrial school, is now a thriving institution, with 162 students, and an income of £2000 a year. Spinning, weaving, navigation, hydraulics, chemistry, and mechanics are there taught.

English Buildings.

11. The City and Guilds of London Central Technical Institution, South Kensington.—The drawings for this magnificent enterprize are particularly deserving of study. The architect of the building has developed the intentions of the Executive Committee in the broad spirit in which they were conceived. In this case not only have the professors of the Finsbury College lent their aid, but the presidents of the Royal Society, of the Institution of Civil Engineers, of the Chemical Society, and of the Society of Arts have each acted on the Sub-Committee, to whom the arrangements of this building have been specially intrusted under the presidentship of Sir Frederick Bramwell, whose untiring labours have mainly contributed to the remarkable success of the Institute. But to the great experience of Mr. Alfred Waterhouse, A.R.A., to his personal supervision of details, and his adoption of the latest improvements in fittings, and in heating and ventilation, we shall chiefly owe one of the most efficient technical colleges of modern times; and although the particular details of the fittings generally are still under consideration, preparation has been made for them as indicated in the plans which are reproduced in Illustrations xxxix-xliii, figs. 105-109.

The building has a frontage of 300 feet, and a depth of 120. The main front building is five storeys in height; the north-western wing is 80 feet wide, and four storeys in height; the south-western wing is postponed for the present. In the rear of the central portion of the main front is a single-storey top-lighted workshop, 100 feet long, by 50 feet wide. The main staircase is in the centre of the building, and a 10-feet wide corridor runs right and left the whole length of the building. The west wing is divided by a central corridor at right angles with the main corridor, connected by the northern staircase, on the south side of which is the great chimney and ventilating shaft, 120 feet high.

The special subjects to be taught technologically are limited to physics, mechanics, chemistry and art, as chiefly required in industrial art development.

The whole of the basement, ground and first storeys of the front building, situated on the southern side of the main central entrance, is devoted to physics, which for the present will share with mechanics one of the lecture-rooms in the north-western wing, under which is the room for metallurgical operations.

The remainder of the basement and ground floor is devoted to mechanics. The chemistry and mechanics lecture-rooms are in the north-west wing.

On the first floor over the main entrance is the reading-room and library, and the remainder of the north end of the main building is devoted to administrative offices and the council chamber. The whole second floor of the main front building, except the four northernmost rooms, is devoted to art and mechanical drawing. The remaining rooms on this floor and on the next, as well as on the two upper floors of the western block over the lecture-rooms, are given up to chemistry. The museum is on the top of the central block.

12. The Yorkshire College, Leeds.—This college, of which the foundations are now being laid, is one of the latest outcomes of applied science teaching and construction. The contract was signed in July (1882) last, and comprizes the three sides of an irregular quadrangular building, the central inclosure of which is destined to be the museum of specimens, models and apparatus required for illustrating the various sciences and arts to the teaching of which the building is to be devoted. This central museum gives the key-note to the general arrangements of the plan. It is an inexpensive way of obtaining what is never absent in Continental examples and rarely present in our own. This museum does not form part of the present contract; but it will doubtless be included in the subsequent contract for the fourth side and its wings, intended to provide the administrative chambers, the library and the arts department, which have to be temporarily provided-for in the present contract.

The masterly planning of Mr. Waterhouse has been chiefly inspired by Professor Thorpe and his professional associates, by whom the various requirements have been carefully considered, and after several years of anxious thought and comparison with earlier examples, the numerous problems so difficult to solve have been worked-out in a remarkably able manner. The irregularity of the site has provoked an original treatment of plan [Illustns. xliv, xlv, figs. 110-122] and a picturesqueness of exterior design which has nevertheless in no way injured the internal convenience.

A 13-feet wide cartway entrance from Clavering Road gives access to the centre of the northern corridor, and through it to the central museum or general scientific collection; and at this point some spare rooms, the coal and heating-apparatus cellars, occupy the basement. East of the cartway, on the ground floor, are the physics lecture-room and preparation room, beyond which is the physics laboratory, fitted with stone wall-tables on stone brackets and with draught-closets. A draught-place and a glazed hot-closet are provided between the preparation-room and the lecture-room. The lecturer's table has a stable foundation of piers and arches, with a concrete floor behind it. To avoid magnetic influences deranging the delicate experiments carried-on here, no iron is admitted into the construction of this room; even the steam-heating pipes are excluded, and the warm air therefrom is conducted thither by special flues. Special arrangements, under the control of the professor, are made for darkening the room and exhibiting diagrams.

The building is to be heated by steam and ventilated by extracting-fans, the fresh air inlets passing over the steam boxes situated at every window-back. A point in this building will be the distribution of steam power throughout, not only for turning shafting for machinery and dynamos, but for chemical laboratory operations, evaporating and drying closets, &c.; and on the whole this institution bids fair to deserve the high encomiums which Professor Roscoe has passed upon it, and of which Yorkshire may well be proud.

13. The Technical College, Finsbury.—This building is just completed or very nearly so. It is the first important work of the City and Guilds of London in point of time, if we except the Kennington Art Schools under the care of Mr. Sparkes. And it represents a model of the kind of structure which should be within the means of every important provincial town. Originally designed as a Trade School, it has developed into a Technical or Applied Science College for working-men and apprentices. Chemistry and physics were first provided-for, but ultimately mechanics was added, and the Professors Armstrong, Ayrton and Perry have done the best they could with the limitations prescribed by the only available site abutting Tabernacle Row on the one side and the playground of the Cowper Street schools on the other. The architect of the building is Mr. E. N. Clifton. The general arrangement of the building is as follows: On the second floor, the iron staircase occupies the centre of the place. The great chemical laboratory occupies the east side, and is divided by two iron columns into senior and junior laboratories. The senior students are on the south side, with five double benches down the centre of the room and wall-benches next the south wall. On the north side are the junior students' detached benches and wall-tables; and the demonstration table and platform are on the east side.

The hooded draught-flues from these tables supersede special stink-closets. On either side of the great chimney-shaft are the exit doors to landing, from which on the north side is the balance-room with its stone wall-brackets, &c., and on the south side are the demonstrators' rooms. The adjoining small staircase leads to the flat roofs and to a large mechanical drawing school. Beyond the staircase are the conveniences for students.

At the western end of the landing, on the south side, is the chemistry professor's room, out of which are his laboratory and his room for special operations, carefully fitted with working-benches, sinks, draught-closets, &c. The chemical glass store and the re-agent store-rooms come next. There is also a large class-room, between which and the balance-room is the gas analysis-room. On the first floor, under the chemical laboratory, are the two large lecture-rooms—one for physics and mechanics, the other for chemistry—with the students' common-room under the upper part of galleries. Each lecture-room has its preparation-room adjoining, and glazed opening in centre behind lecturer, giving access to same for apparatus, besides the door of communication. There are foul air-shafts and floor draught-channels in connection with the lecturers' tables and preparation-rooms. At the western end are rooms for experiments on light and for mechanical engineering, adjoining which is a physics plan-drawing room.

On the ground floor is the entrance to the building from Tabernacle Row, under a stone portico, and opposite the vestibule is the great central staircase with landings on its three sides. On the right of the entrance are rooms for the secretary and the clerks; next which are the mechanics professor's room and the physics workshop with class-room adjoining, fitted with Moss's patent benches. At the north-east corner is a mechanical drawing office, and a physics laboratory adjoins. At the west end are two physics laboratories and the physics professor's private room. Seven steps below level of ground floor and lined with white glazed bricks is the chemical brewing-room. In the basement under the brewing-room and six steps below the general basement level are the heating furnaces and boiler-room, and the heating-chamber, fitted with wrought-iron hot water pipes, with the fan at one end and the channel flues at the other. West of this room is a physics laboratory with gas-engine, adjoining which is the physics store-room,

with a brick wall to carry stone tables above. At the south-west corner is the chemistry gas-testing room, adjoining which is the metallurgical laboratory. The eastern half of the basement is devoted to mechanics—first a general laboratory or class-room, then a wood workshop, then an iron workshop, and finally the engine-room, with 14-horse-power condensing engine and multitubular boiler.

This engine not only turns the shafting, but provides the power for working the dynamo for producing the electricity with which the building is lighted, and the electrical experiments are carried-on in connection with all the laboratories. There are areas at the back and in front, with a series of vaults under the pavement. The whole of the basement is lined with white glazed bricks.

14. University College, London.—This college, founded in 1826, incorporated in 1836, and chartered in 1869 for special purposes, was extended in 1871 for the Slade School; and, in 1878, the foundation stone of the north wing, last completed, was laid by Lord Granville. The new buildings, designed by Professor Lewis, and carried-out by Messrs. Perry and Reed, provide improved and extended accommodation for the Slade School of Fine Art; and for zoology and comparative anatomy. The whole upper floor of the north wing has been devoted to physiology. On the ground floor and basement, chemistry is provided not only with space in the north wing itself, but also with a large annexed laboratory on the ground behind. Rooms set free in the centre of the building, by these new arrangements, have been so dealt-with as to secure proper accommodation for the School of Engineering and a laboratory for practical botany. The physiological department consists of a set of eleven rooms, among them being a lecture-room for 170 students, and a working-room for 100 students, with large windows to the north. Each worker is provided with gas supply for heat and light, water supply, and a locker or cupboard for his microscopes, instruments, &c. The seats and tables are in parallel rows facing northwards, each row being three feet above the row in front of it; in this way the light which it receives nearly horizontally cannot be intercepted. The other rooms are for various purposes. In the department of chemistry, the new analytical laboratory is a lofty hall (74 by 25) lighted from above. It contains working-benches for 50 students, all of whom are as far as possible prevented from communication with or overlooking one another; and in this respect it is quite unique. In the middle of the laboratory are draught-tables and appliances for general use.

15. Owen's College, Manchester.—The chemical laboratory at this College, executed from the designs of Mr. Waterhouse, in accordance with the arrangements prescribed by Professor Roscoe, is one of the earliest and best of English examples. The chief features of the building are two large laboratories, each 70 feet by 30 feet, and 29 feet high. One laboratory is devoted to the first year or qualitative Students, in which there are working places for 60 students in 6 blocks of 10 places in each. The other is ranged for 40 advanced or quantitative students, and contains 10 blocks of 4 places in each. Parallel with the quantitative laboratory, and divided therefrom by a corridor, is a series of rooms, viz.: two balance-rooms, organic analysis and gas analysis rooms, a library and organic chemistry lecture-rooms. At one end of the two laboratories is the staircase, on one side of which is the chemical store and re-agent room, and on the other the Professor's private room—over which are Professor Roscoe's private room, overlooking both laboratories, and his private laboratory and balance-room. In the

basement is a third large laboratory for fifty medical and for evening students, a metallurgical laboratory containing furnaces, a store-room, class-room, lavatory and cloak-room, spectroscopic room, photographic-room, dark-room for photometry, boiler-house and three preparation-rooms. The large theatre for 380 students is detached from the working laboratories, and has its lecturer's laboratory or preparation-room, draught-closets, sinks, &c. adjoining in the rear, and communicating directly with the space behind the lecturer's table.

The ventilation of the laboratory is both general and special. The general ventilation is effected by a perforated boarded ceiling running the whole length of both laboratories and conveying the vitiated air, by a large air-trunk, to the shaft, within which rises the smoke-flue of the furnace. The supply of fresh air is obtained from a high level by a fresh air-shaft, down which the air passes, being drawn over the hot air-pipes by the aspiration of the chimney, and passing into the laboratories through gratings placed in the walls. The special ventilation is also worked by the main shaft, and is divided between the evaporating-niches in the walls and the sulphuretted-hydrogen-closets. Each of the niches is provided with an upright glazed earthenware pipe, 4 inches in diameter, running into a horizontal pipe of the same material 12 inches in diameter, communicating with the draught of the main chimney. The large niches at the end of the laboratory aspirate 100 cubic feet of air per minute, each of the smaller ones in side walls 12 cubic feet per minute. The sulphuretted-hydrogen-closets in each working-bench are joined together in groups of two and four, and placed in connection with a 7-inch or 4½-inch glazed earthenware pipe, communicating with a horizontal flue shown in section, running between the fire-proof arching and the floor, and passing into the chimney shaft. Each closet in No. 1 laboratory aspirates at the rate of 5 cubic feet per minute, whilst those in laboratory No. 2 aspirate 20 cubic feet per minute —those at the farthest end of the laboratory differing but slightly from those nearest the chimney.

16. The Manchester Grammar School.—The best is here made of a very limited space. The arrangement of the rooms is singularly good, and the fittings are admirable. The architects were Messrs. Mills and Murgatroyd, and high praise is due to Mr. Jones the Master, who made a study of every detail. The chemical science department occupies six rooms on the second floor. The gymnasium is in the centre of the school quadrangle, and the galleries form the gangway to the laboratory and lecture-room. The chemical laboratory is fitted-up with operating-benches for ninety students—with demonstrator's table at one end, and assistants' table at the other—and both at right angles to the benches they command. Draught-places are placed in three of the five windows. There is a special sulphuretted-hydrogen-room at one end, with draught-place and sink and furnaces. The ventilating shaft, with central iron smoke-flue is at hand, and ready for the withdrawal of all the vapours. At the other end of the laboratory are the balance-room, the class-room with lecturer's table, the apparatus-room and preparation-room adjoining the chemical lecture-room; between the lecture-room and the apparatus-room is a draught-closet, and there is a sink communicating with each.

17. Mason College, Birmingham.—This College, founded by Sir Josiah Mason ten years ago, has only been completed within the last two years. It was originally designed to teach only chemistry, physics and mathematics. When the building was partly roofed-in, it was determined to add to the above sciences, physiology, geology, mineralogy and botany.

Considerable modification of the original plan was obviously necessitated. When the work was well-nigh completed engineering was added, and afterwards biology. In judging, therefore, of the arrangement of this college, these facts must be borne in mind. The site also was very circumscribed and surrounded by buildings, so that the principal lighting had to be derived from internal quadrangles, and great height was necessary—the blocks varying from three and four to five storeys in height.

18. The Merchant Venturers' School, Bristol.—Finally, I will cite this school as an example of a provincial city Trade and Mining School. The building comprizes four storeys, on the topmost of which are situated the chemical, physical, and metallurgical laboratories and lecture-rooms, the combustion-room, balance-room, special operation-room and the master's rooms, with an observatory in the turret. The first floor contains the engineering lecture-room, the drawing schools and the plan-room, also a series of four general class-rooms opening into the gallery of the great hall. The ground floor [Illustn. xlvi.] has a similar series of class-rooms, entered from the great hall open aisle. This is one of my own buildings, and in it I have applied the principle of planning (which Dr. Abbot termed the "hall-passage system)," in accordance with the views expressed in my lecture on "Secondary School Buildings," delivered at the Society of Arts in 1880. Beyond the hall class-rooms are the library and museum, the waiting-room, the head master's and committee rooms. The basement floor is level with Denmark Street at the east end, and two-thirds below the level of Unity Street at the west end, of the building, owing to the slope of the hill from College Green. It comprizes an art-school, and the engineering workshops and machinery, the luncheon-room, cloak-rooms, also engine, boilers, hot water-apparatus and coal-stores; the kitchen offices complete form the basement floor of the caretaker's house—the top storey of which is to be devoted to a general drawing school. The cost of this building will be over £35,000, and it affords another example of the public spirit still remaining among the ancient guilds.

[Remarks by Professor H. E. Armstrong, Ph.D., F.R.S.]

On comparing together the plans of the various laboratories described by Mr. Robins, it will be noticed that there is a somewhat important difference between the English and foreign schools. In the latter, separate laboratories are provided for students engaged in qualitative analysis and for those engaged in quantitative analysis, and therefore usually the junior are separated from the senior students. In the English schools the division is less absolute, and the two classes of students are accommodated either in contiguous apartments, as at Manchester, or in one large room which is partially subdivided, as at the Finsbury College. The English plan has the advantage that it renders it easier to supervize the students, a point of some importance, as the teaching staff is, as a rule, much smaller in proportion to the number of students in the English than in the foreign schools. As the requirements of the two classes of students are very nearly the same, however, there is no reason why the one plan should always be adopted in this country. The comparative smallness of the provision for the teaching of organic chemistry in the English schools will also be noticed; this mainly arises from the fact that unfortunately the English student, or rather his father, does not as a rule

think it necessary to prolong his studies for nearly so long a period as is usual abroad. With reference to the all-important question of ventilation, after inspecting the chief foreign examples, I am of opinion that it is proved over and over again that artificial ventilation must of necessity be resorted-to, and that in all probability a purely mechanical system is the best. The extraction of the foul air by means of a shaft with the aid of a furnace is, I believe, theoretically a less economical method than that involving the use of a fan, and it is well known that fans are now largely employed in mine-ventilation with great success. The latter method, moreover, has the great advantage that a fan may easily be worked at any desired speed, and at a regular and even rate, and requires scarcely any attention; whereas it is difficult always to maintain a current of uniform velocity in a shaft by means of a fire, more especially on account of the difficulty of insuring regular firing, and to a less extent owing to the variation in the specific gravity of air at the different seasons of the year; not to speak of the influence of air-currents blowing across the top of the shaft and in at the open windows. The fan should always be used as an extractor, I think; if, as at Aachen, air can also be injected, so much the better. With regard to the hood covering the benches which I have devized, I am satisfied from actual experience that it will be most efficient, provided that the current be of a sufficiently high velocity. My experiments go to show that the current in the 4-inch square downcast pipes connecting the hoods with the flue below should flow at a rate of certainly not less than about 5 feet per second. There would, so far as the hood is concerned, be no great objection to making the downcast flues of larger dimensions, that is of greater width, in which case currents of less velocity might perhaps be employed to withdraw the foul air from under the hood, but in this case the side openings which are provided in the downcast flues would be of less service when evaporating liquids, &c. The sanitary and other advantages of the hooded covering to all working-benches are, in my opinion, very great in comparison with those arising from the adoption of the system which has hitherto prevailed of having draught-closets against the walls, and I think that we should be prepared to make considerable sacrifices in favour of their adoption, especially in school laboratories, where very young students are engaged, and that vigorous efforts should be made to arrive at the most perfect method of constructing them.

HENRY E. ARMSTRONG.

VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION (xxxvi)

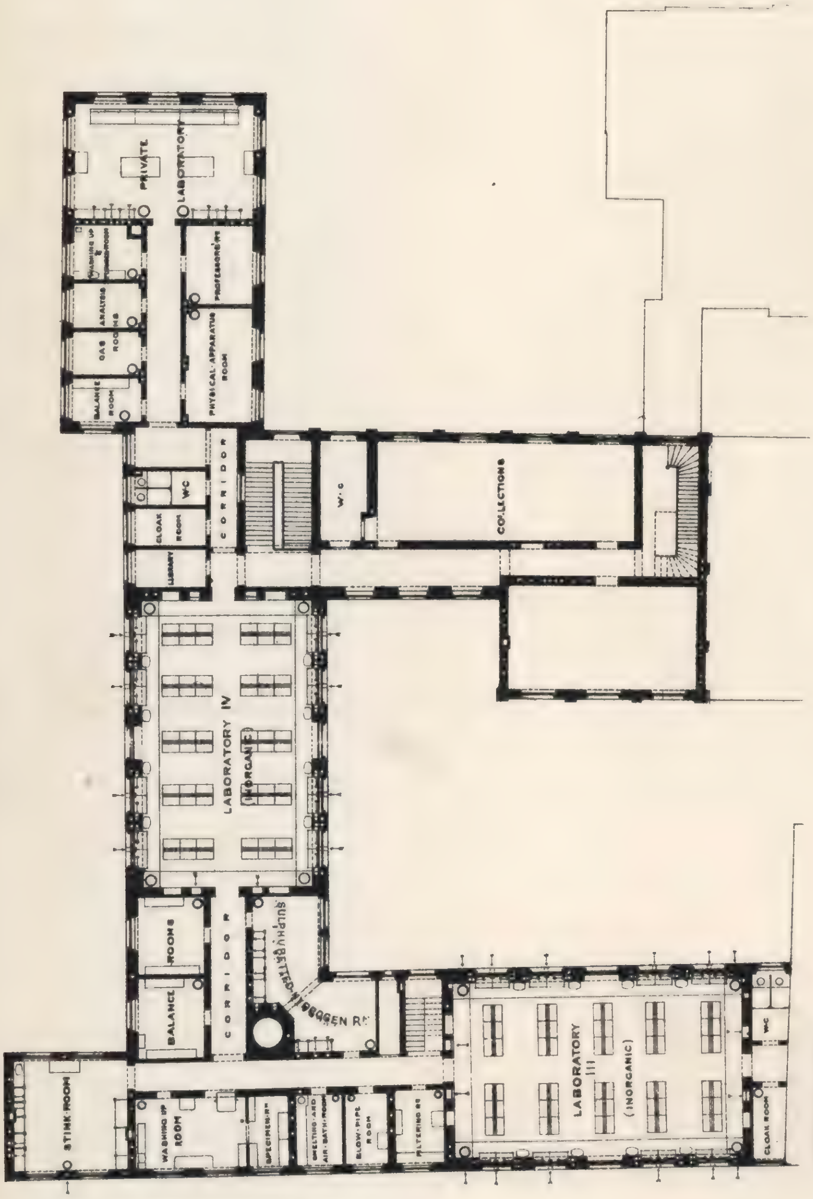


FIG. 96. FIRST FLOOR PLAN.

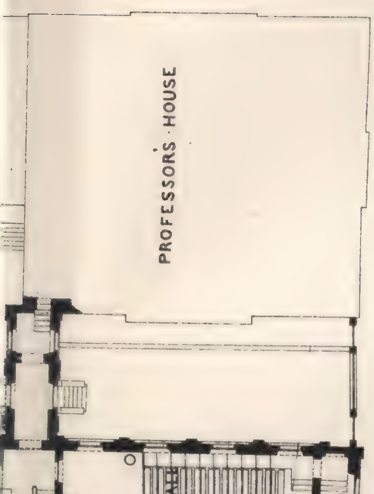
FIG. 97. GROUND

Edward C. Robins, del.

NEW CHEMICAL LABORATORIES, AC

10 5 0 10 20

Scale of F



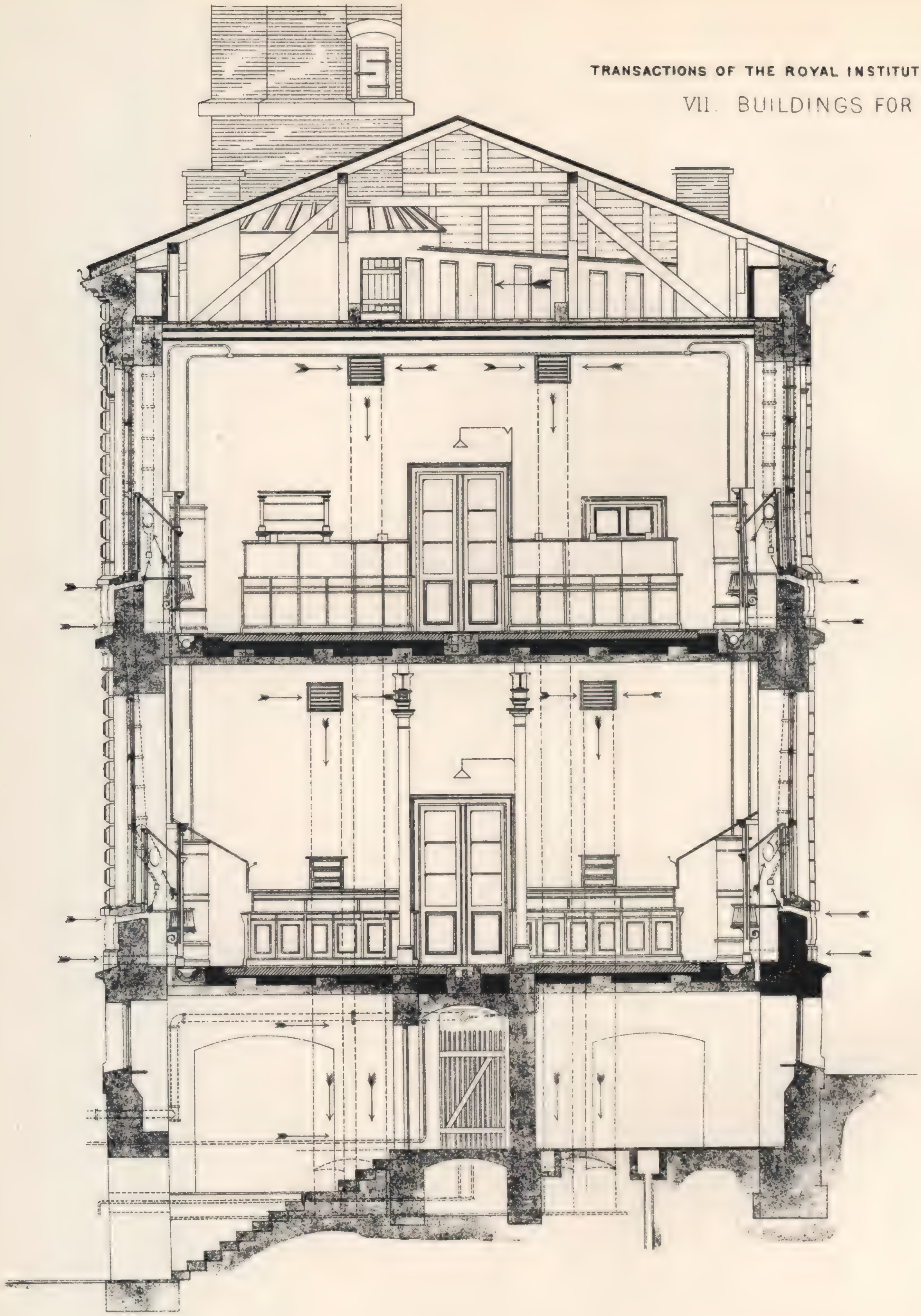
FLOOR PLAN.

FIG. 98. BASEMENT PLAN.

ADEMY OF SCIENCES, MUNICH.

30 40 50
Feet

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.



NEW CHE
ACAD

FIG. 99. TRANSVERSE SECTION THROUGH LARGE LABORATORIES.

Edward C. Robins del.

HEMICAL LABORATORIES,
ADEMY OF SCIENCES,
MUNICH.

10 20 30 40 50
Scale of Feet.

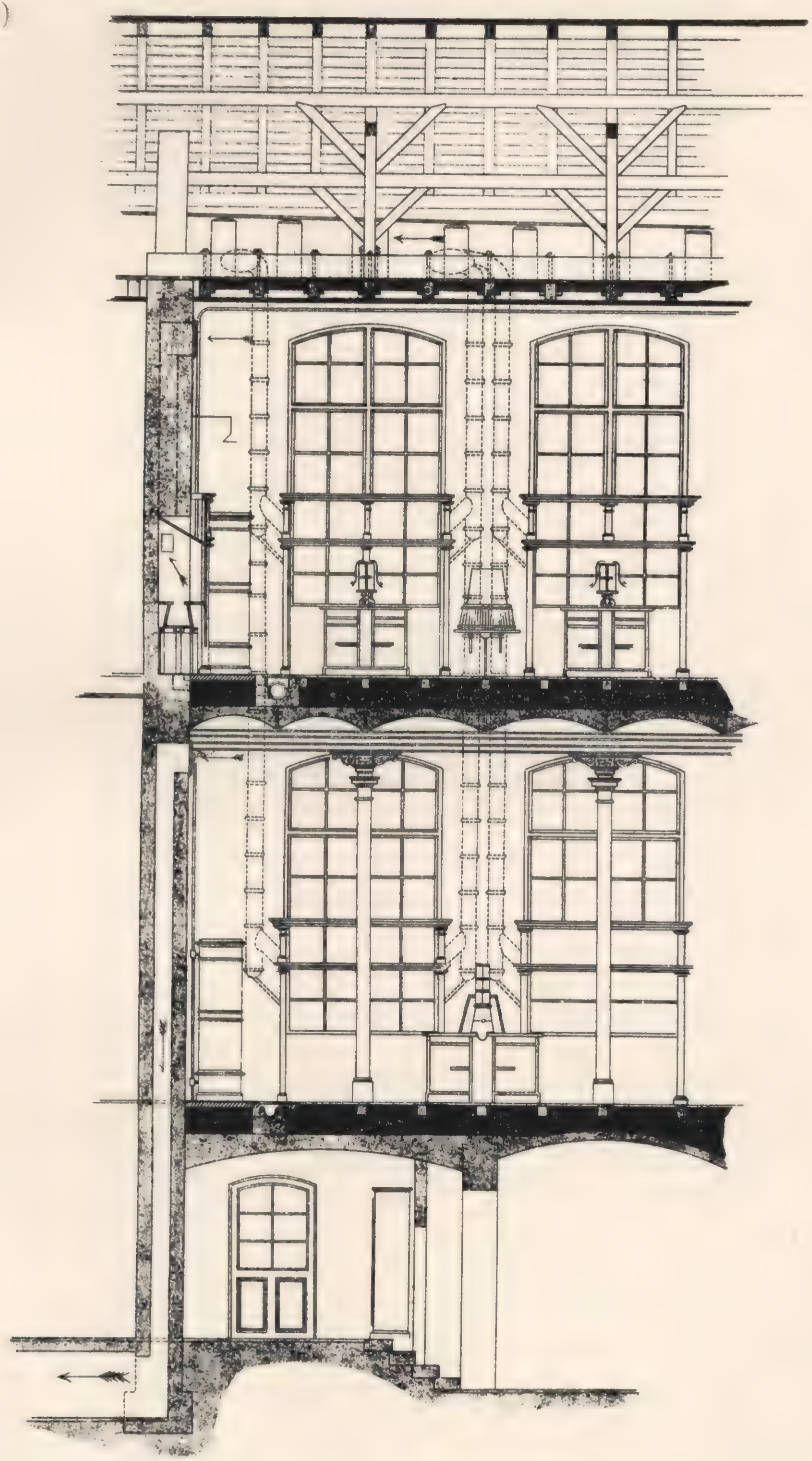


FIG. 100. PART LONGITUDINAL SECTION THROUGH LARGE LABORATORIES.

C F Kell, Photo-Litho, Castle St Holborn, London, E.C.

VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION (xxxviii)

THE PHYSIOLOGICA

BERLIN

0 5 10

Scale of Metr

0 10 20 30 40 50

Scale of Feet

26-30. Chemical research rooms.
31. Spectrum analysis room.
32. Sulphuretted Hydrogen room.
33. State Testing room.
34-35. Assistants' apartments.
36. Incubating ovens.
37. Injecting room.
38. Balance and pump room.
39. Gas analysis room.
42. Microscopic Gallery.

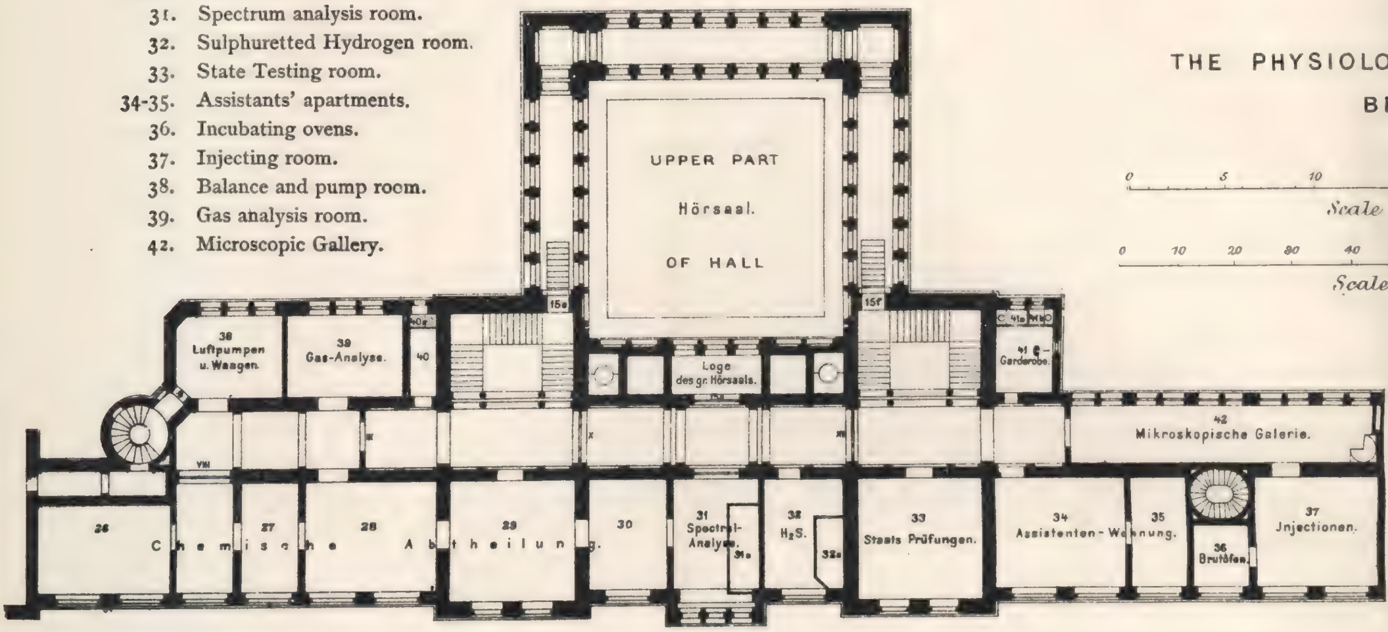


FIG. 103. FIRST FLOOR PLAN.

59. Combustible materials.
60-62. Chemical research rooms.
64. Gas and water metres.
65-70. Porter's apartments.
71. Aquarium reservoir, &c.
72-73. Private dog-kennels and frog store
74. Heating chamber.
76. Rabbit hutches.
79. Engineer's apartments.
80. Combustible materials.
83. Ice cellar.
84. Mortuary.
85-86. Battery room.
87-90. Dog kennels.
91. Frog store.

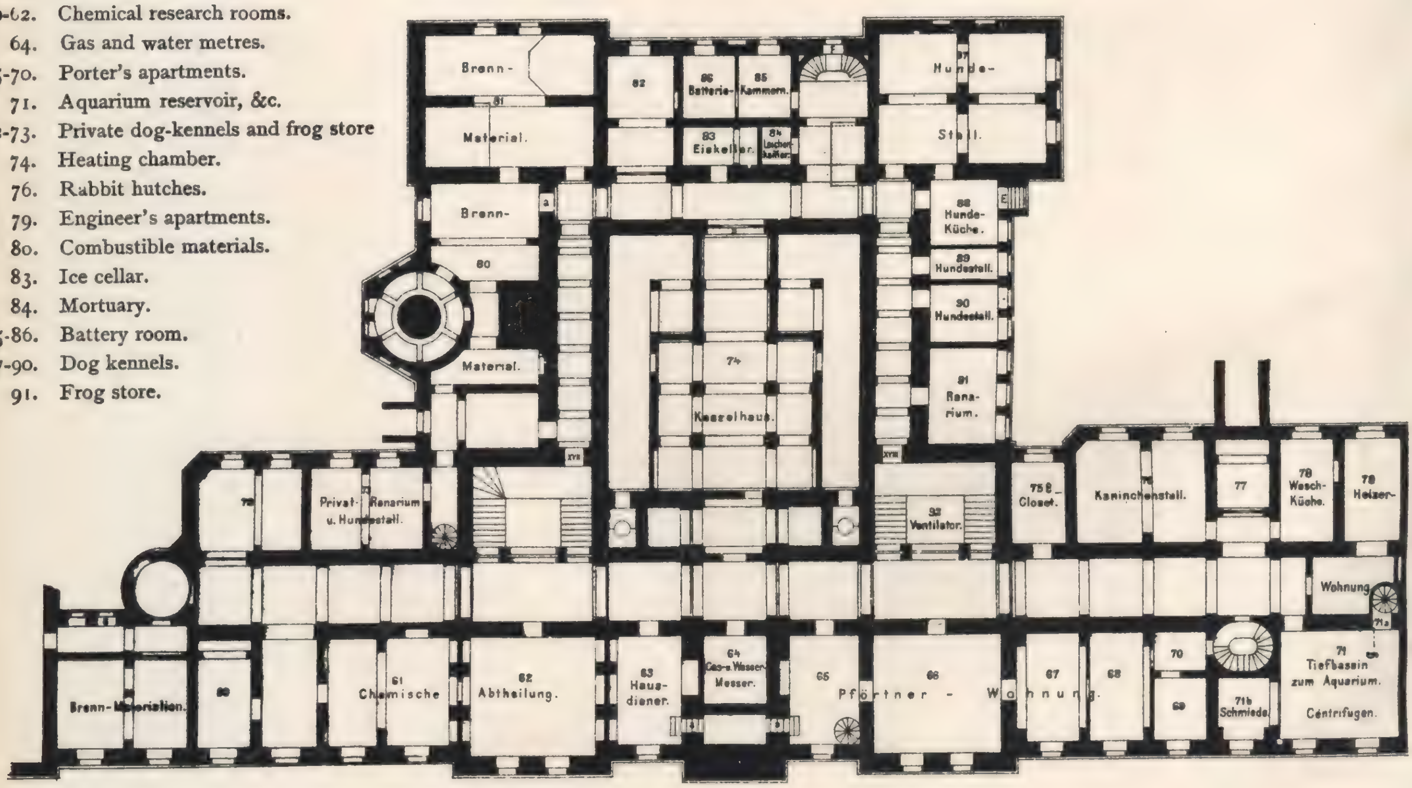


FIG. 101. BASEMENT PLAN.

INSTITUTE.

43-44. Light and dark optical rooms.
45. Photography.
48-50. Servants' apartments.
51-53. Assistants' apartments.
54. Machinists' apartments.
55. Photographic room.
56. Upper part of Hall.
57. Staircase to attics.

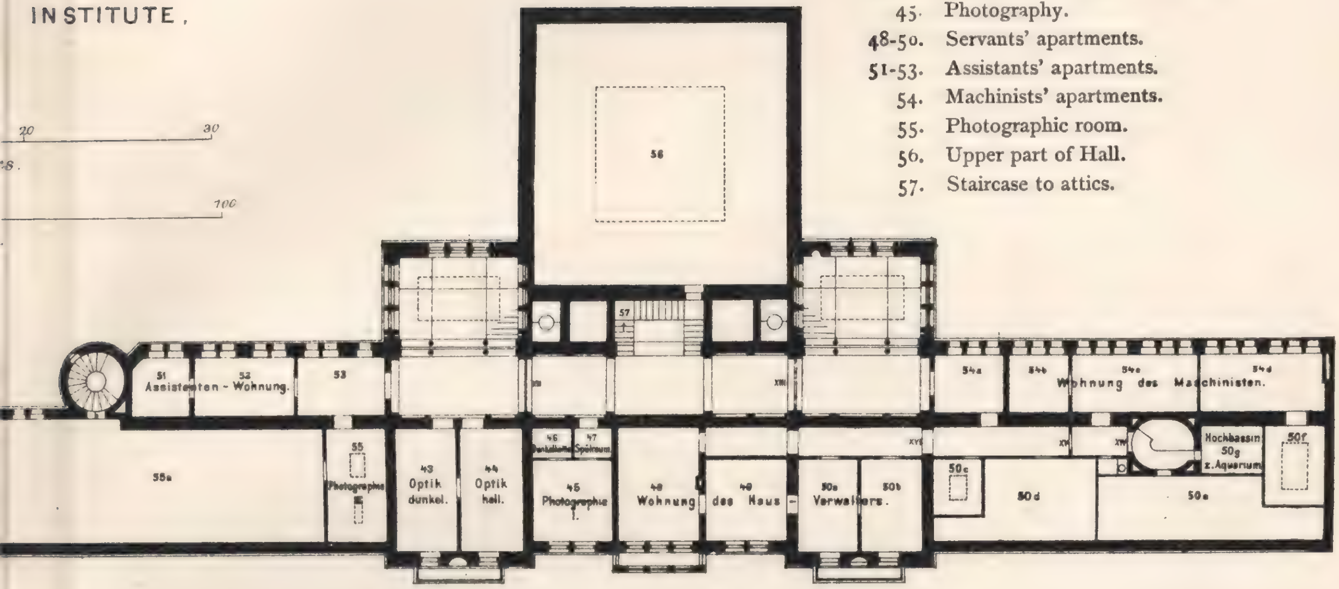


FIG. 104. SECOND· FLOOR PLAN.

-3. Assistants' apartments.
4. Collection of instruments.
6. Mechanical workshop.
7. Library.
-9. Assistants' apartments.
o. Ante-room.
1. Private Chemical laboratory.
2. Ante-room.
3. Small Lecture room.
-4. Aquarium.

15. Large Lecture Hall.
16. Battery room.
17. Private Physical laboratory.
18-20. Physical Physiology laboratory.
21. Diagrams.
22. Preparation room.
23. Professors' room.
24. Vivisection room.
25. Microscopic Gallery and anatomical collection

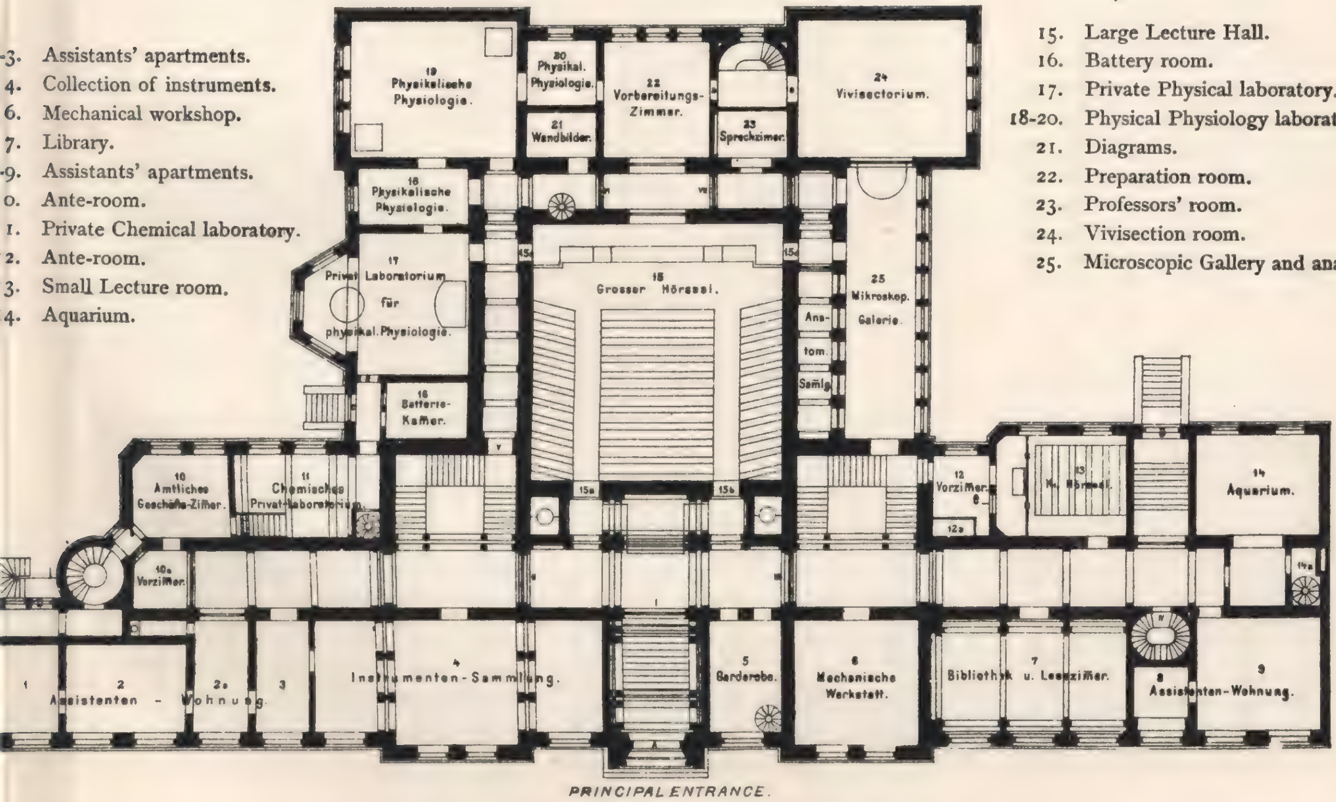


FIG. 102. GROUND FLOOR PLAN.

C.F.Kell, Photo-Litho. Castle St Holborn, London, E.C.

TRANSACTIONS OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS. 1882-83.

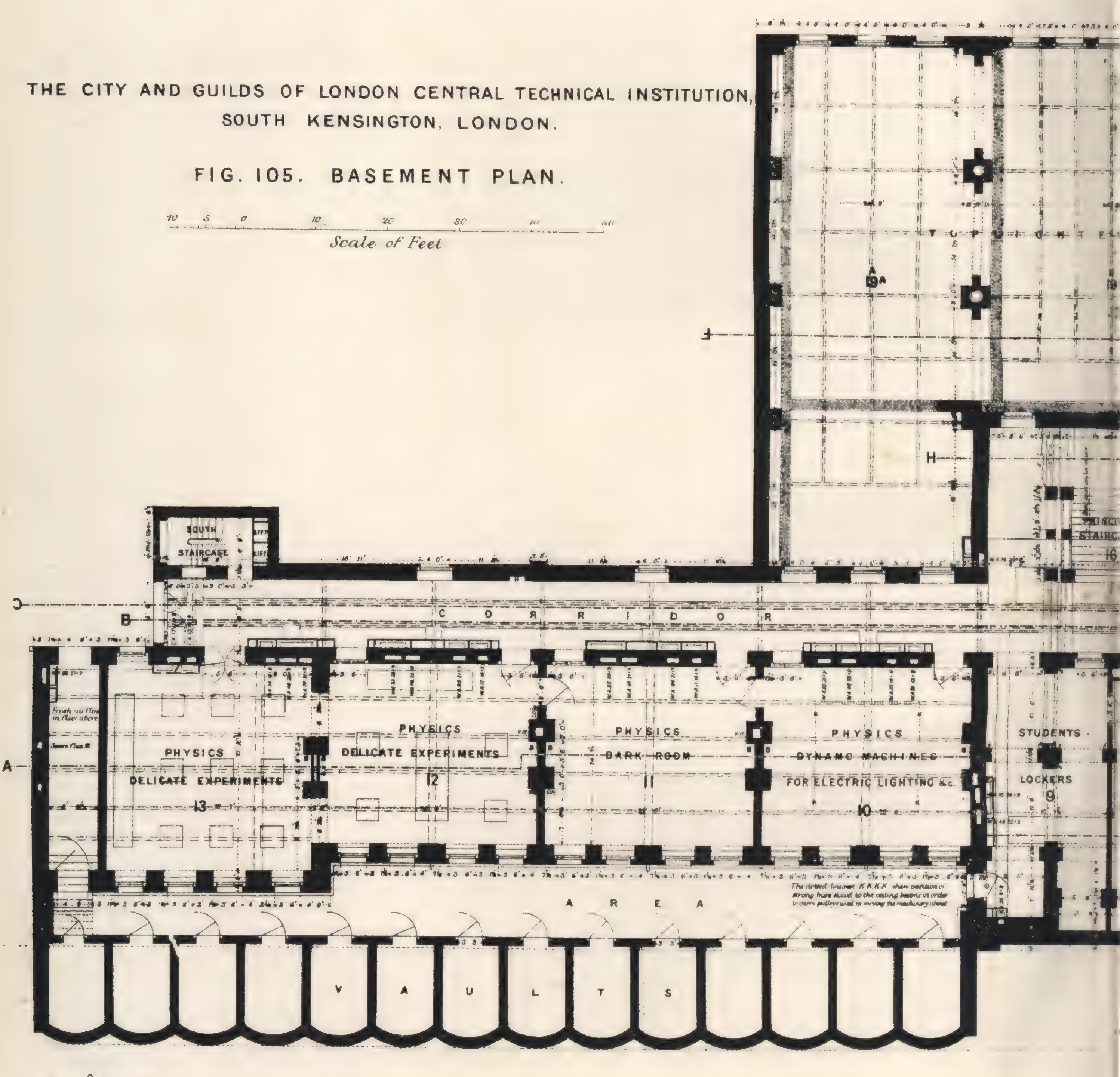
VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION (XXXIX).

THE CITY AND GUILDS OF LONDON CENTRAL TECHNICAL INSTITUTION, SOUTH KENSINGTON, LONDON.

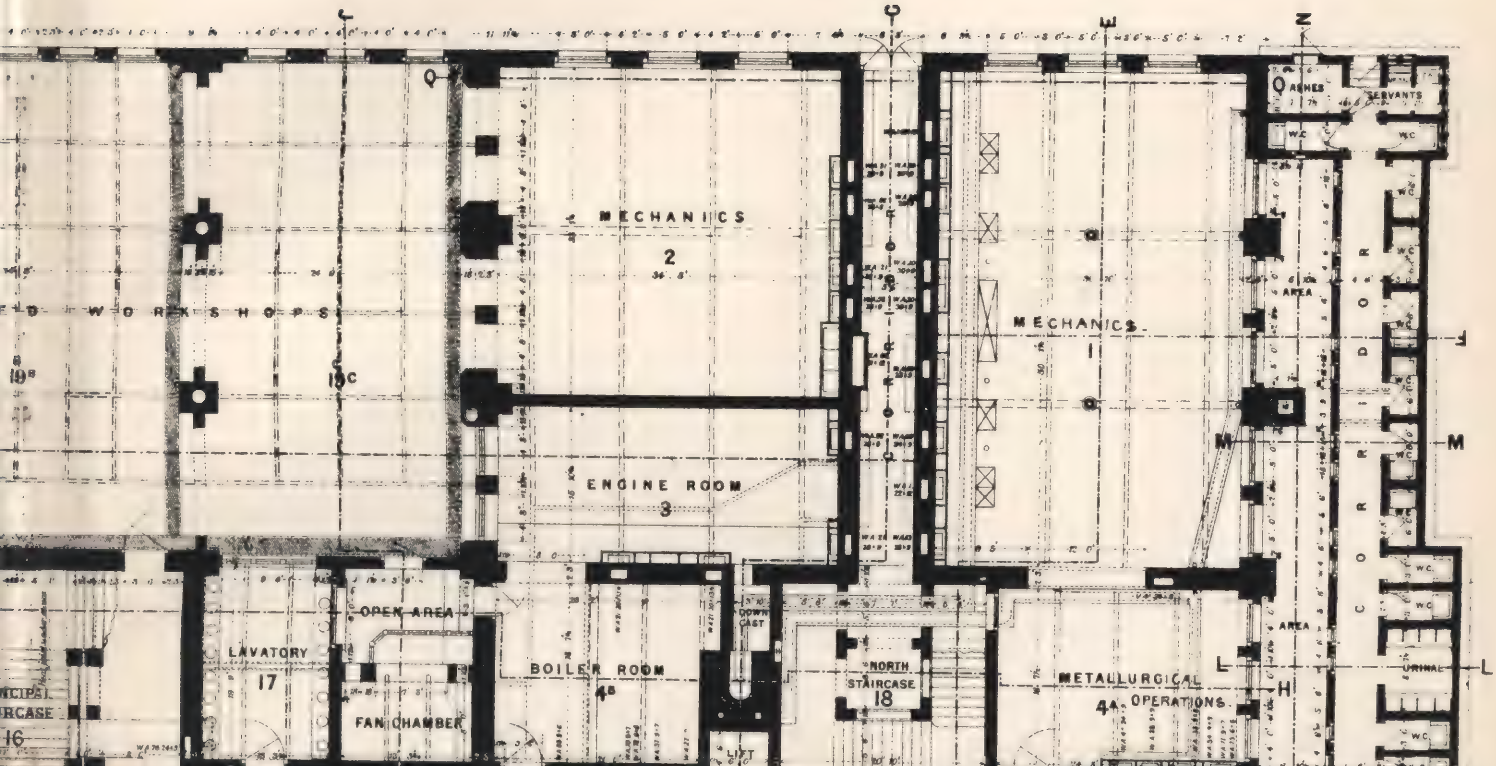
FIG. 105. BASEMENT PLAN.

10 5 0 10 20 30 40 50

Scale of Feet



Alfred Waterhouse



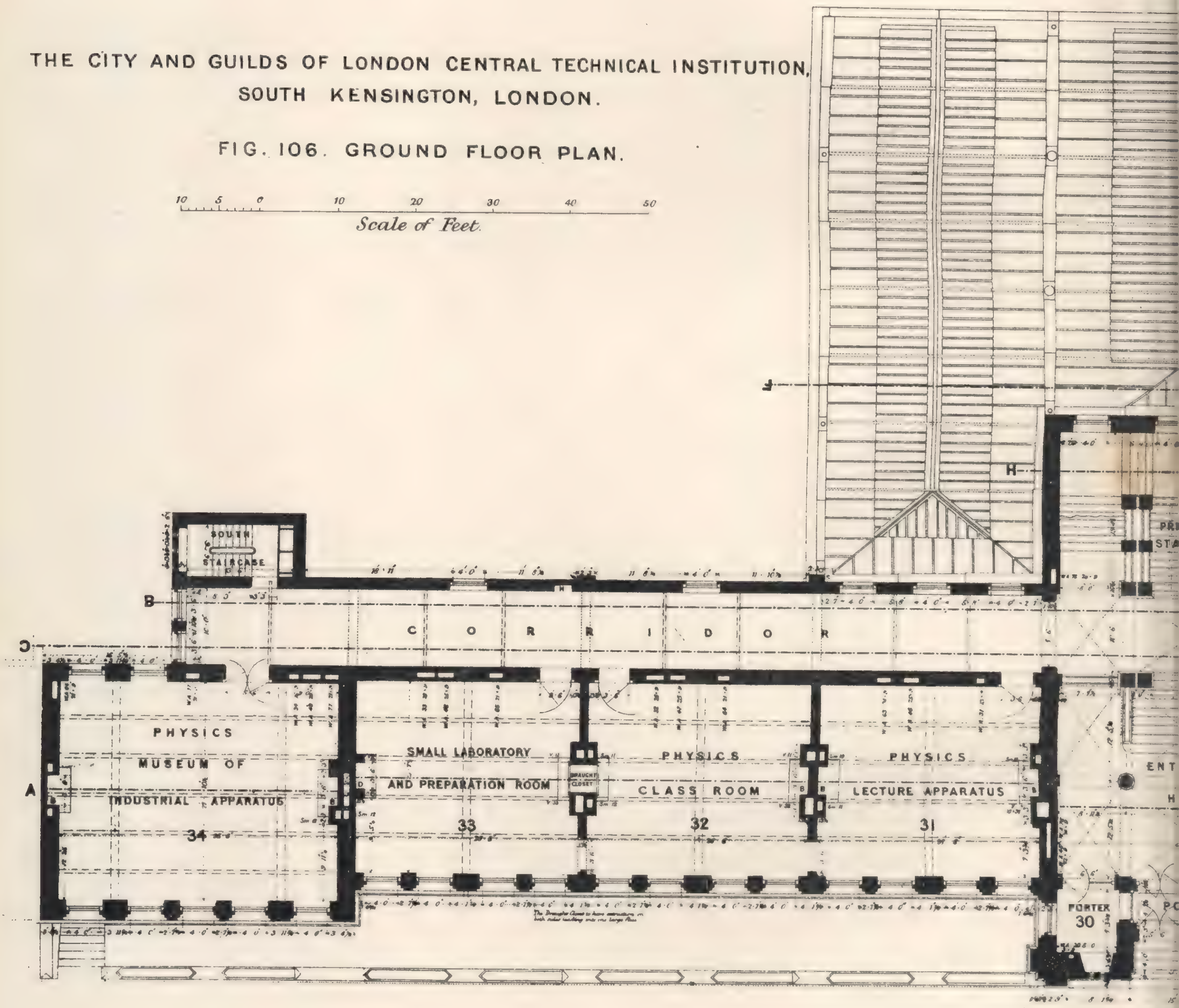
C.F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

THE CITY AND GUILDS OF LONDON CENTRAL TECHNICAL INSTITUTION, SOUTH KENSINGTON, LONDON.

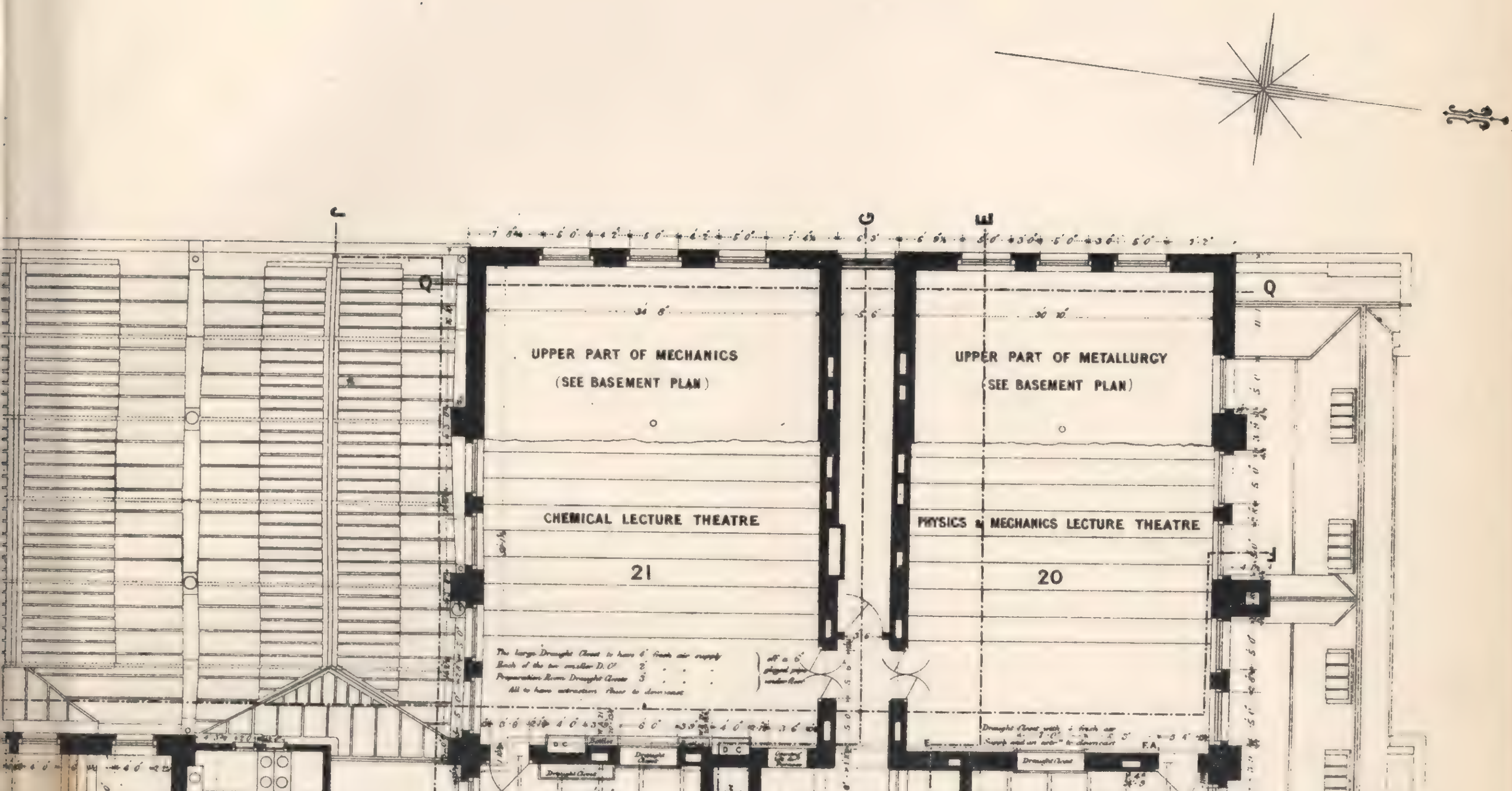
FIG. 106. GROUND FLOOR PLAN.

10 5 0 10 20 30 40 50

Scale of Feet.



Alfred Waterhouse



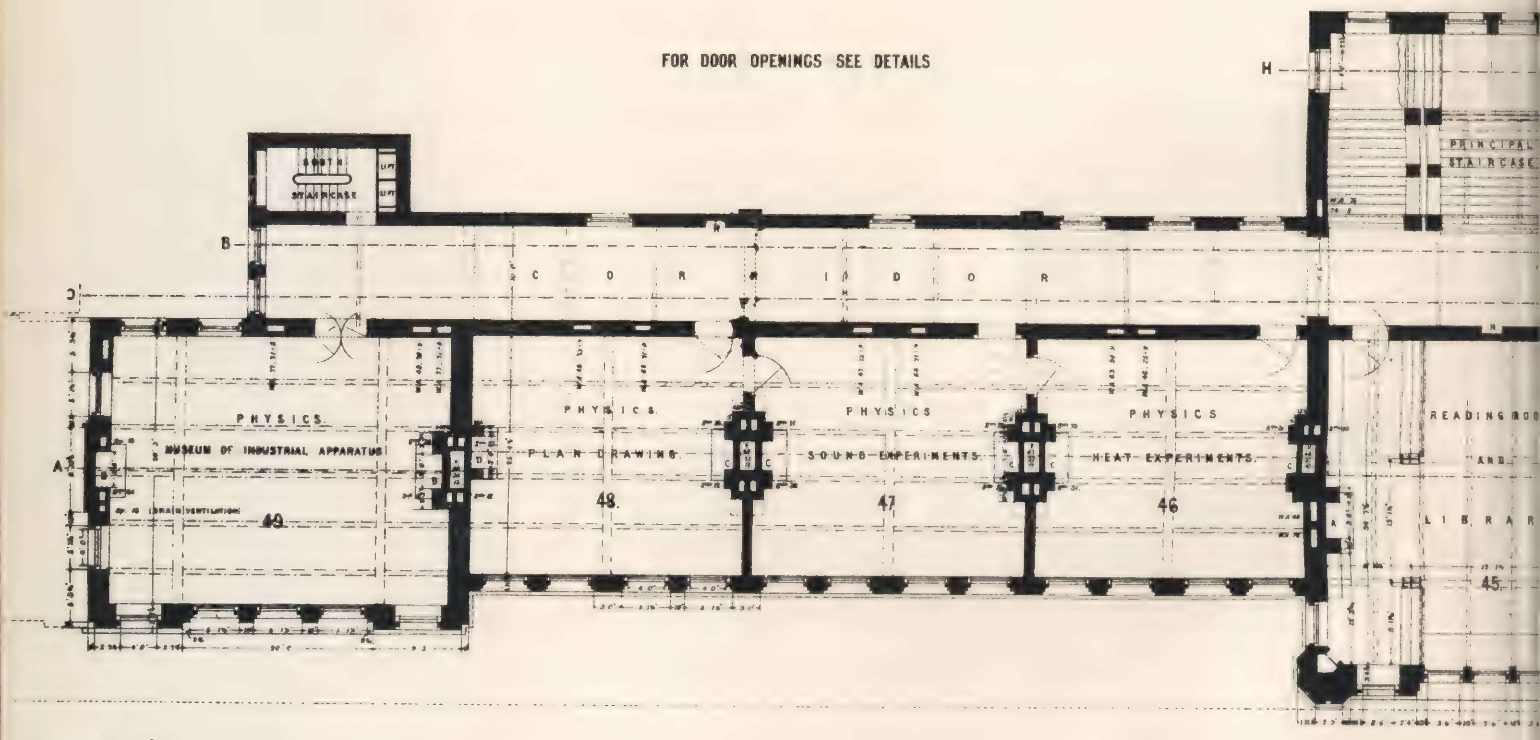
C.F. Kell. Photo-Litho. Castle St Holborn, London, E.C.

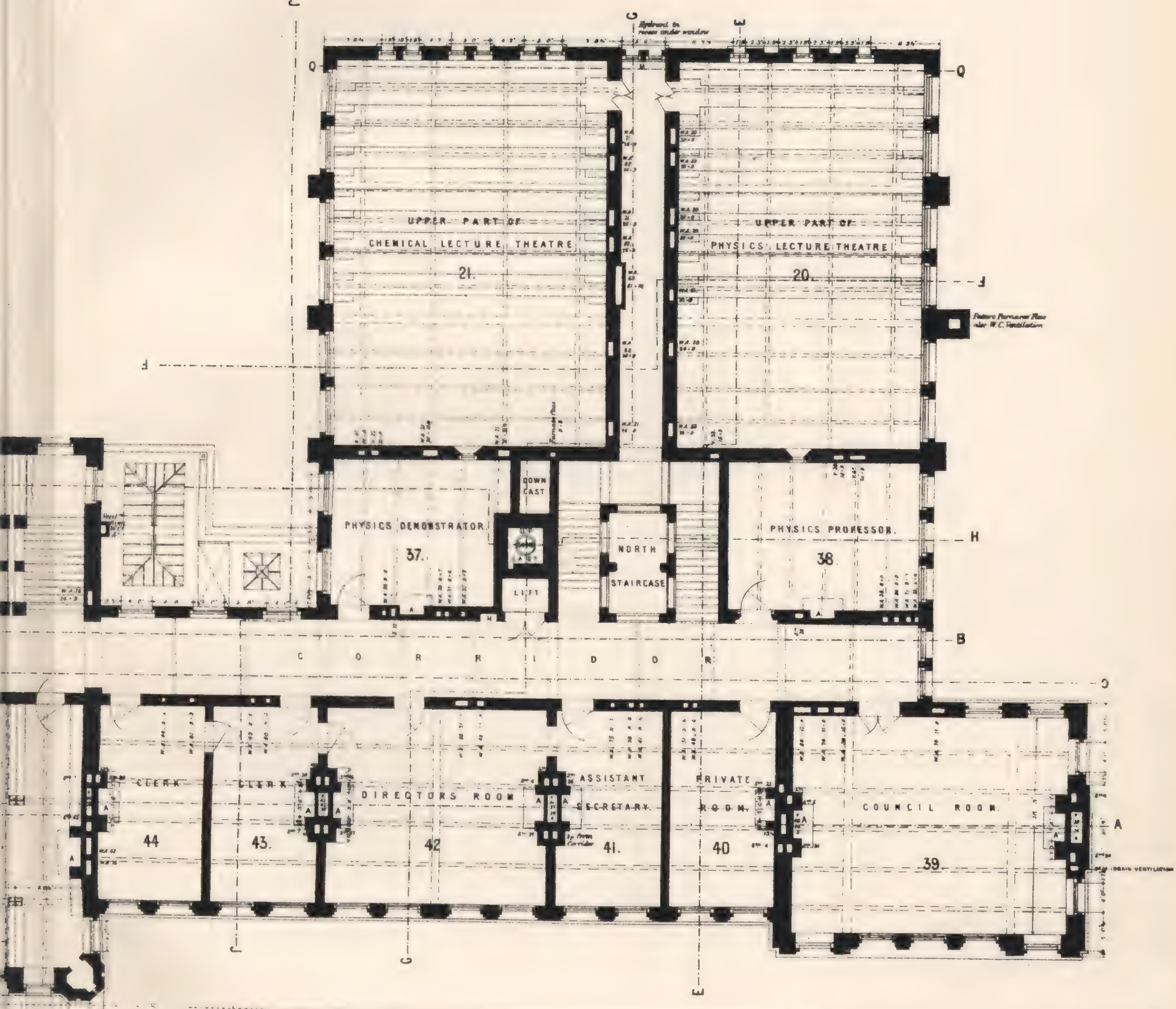
THE CITY AND GUILDS OF LONDON CENTRAL TECHNICAL INSTITUTION, SOUTH KENSINGTON, LONDON.

FIG. 107. FIRST FLOOR PLAN.

10 5 0 10 20 30 40 50

Scale of Feet

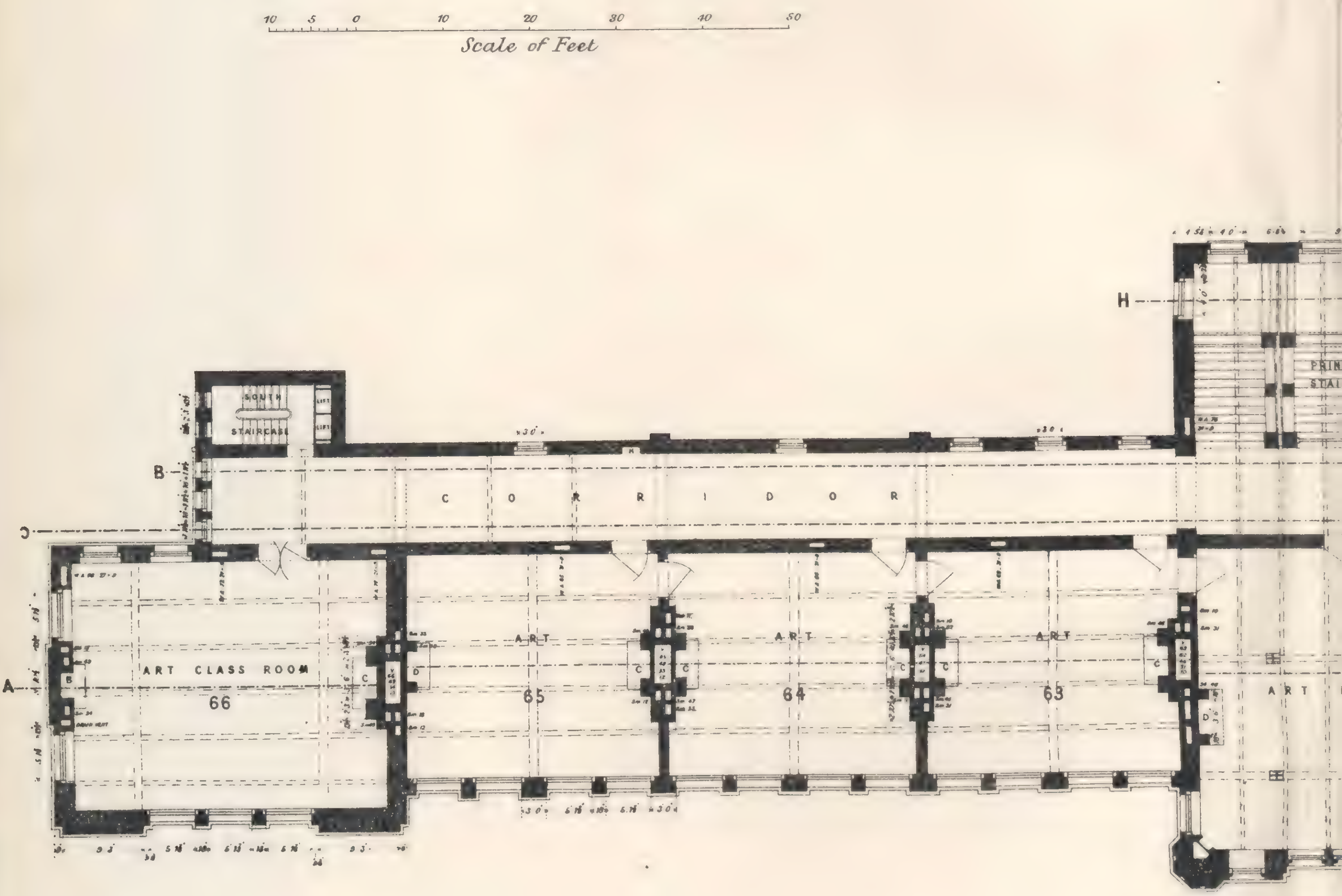


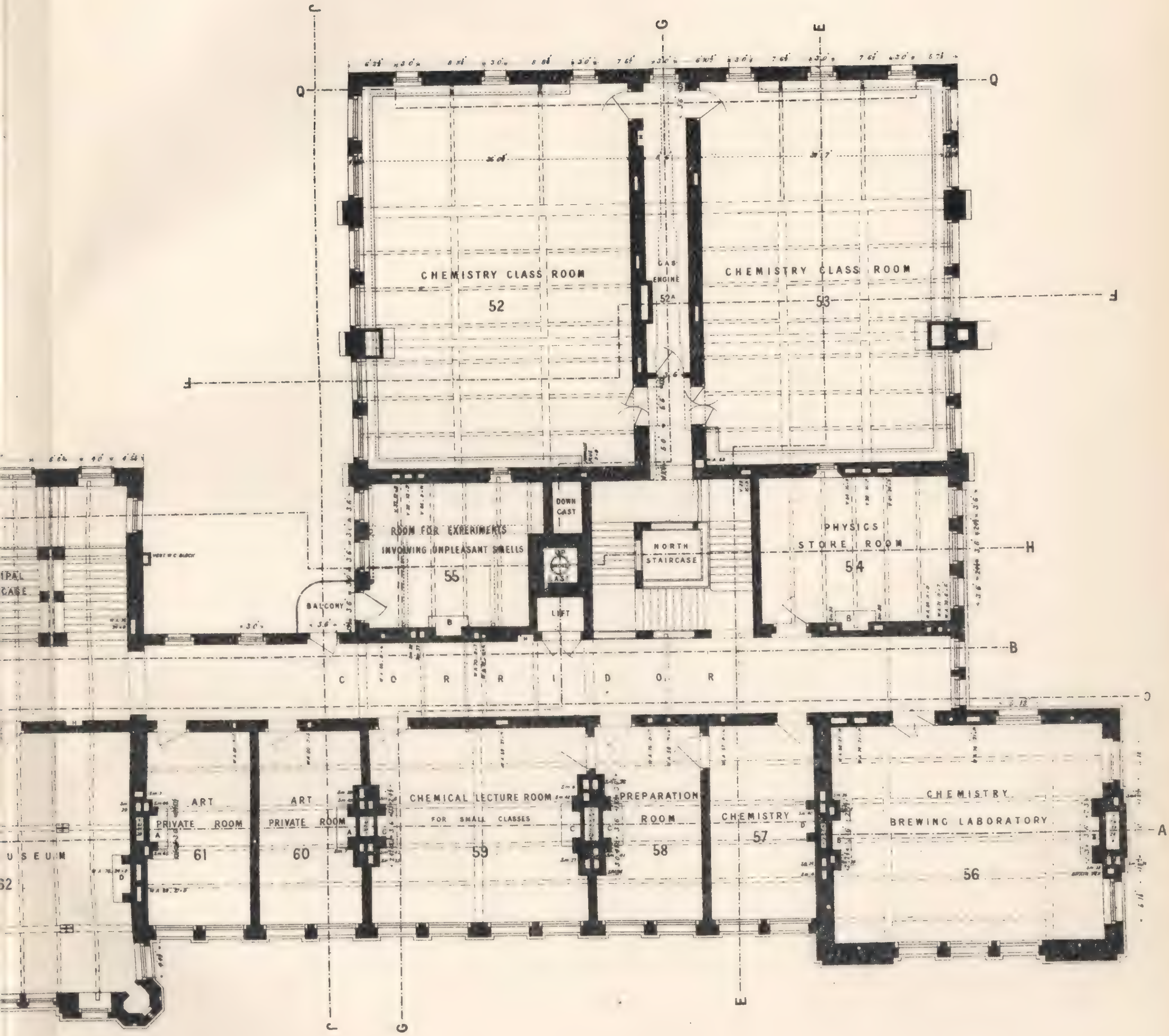


C.F. Kell, Photo-Litho. Castle S^t Holborn, London, E.C.

THE CITY AND GUILDS OF LONDON CENTRAL TECHNICAL INSTITUTION,
SOUTH KENSINGTON, LONDON.

FIG. 108 SECOND FLOOR PLAN.

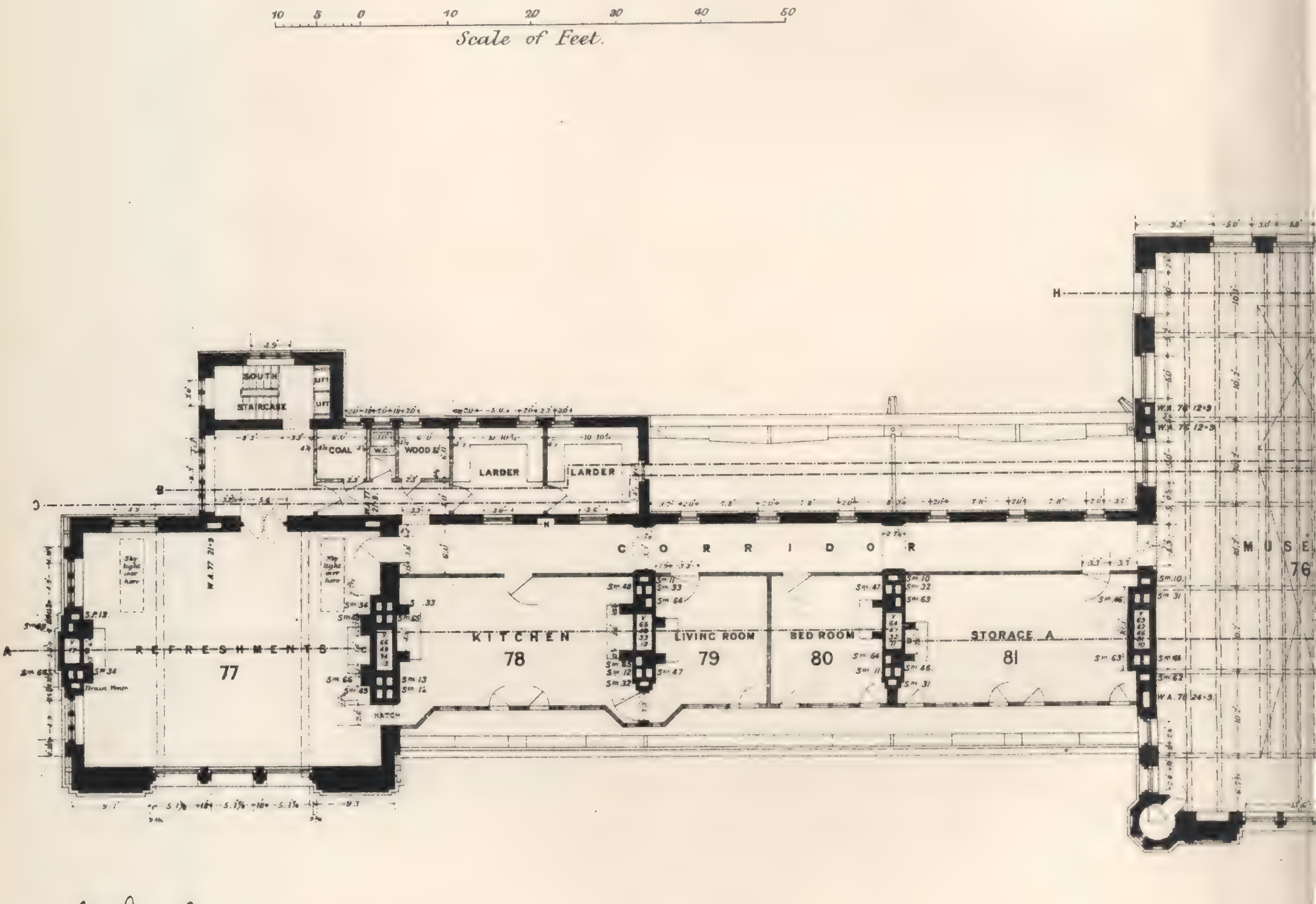




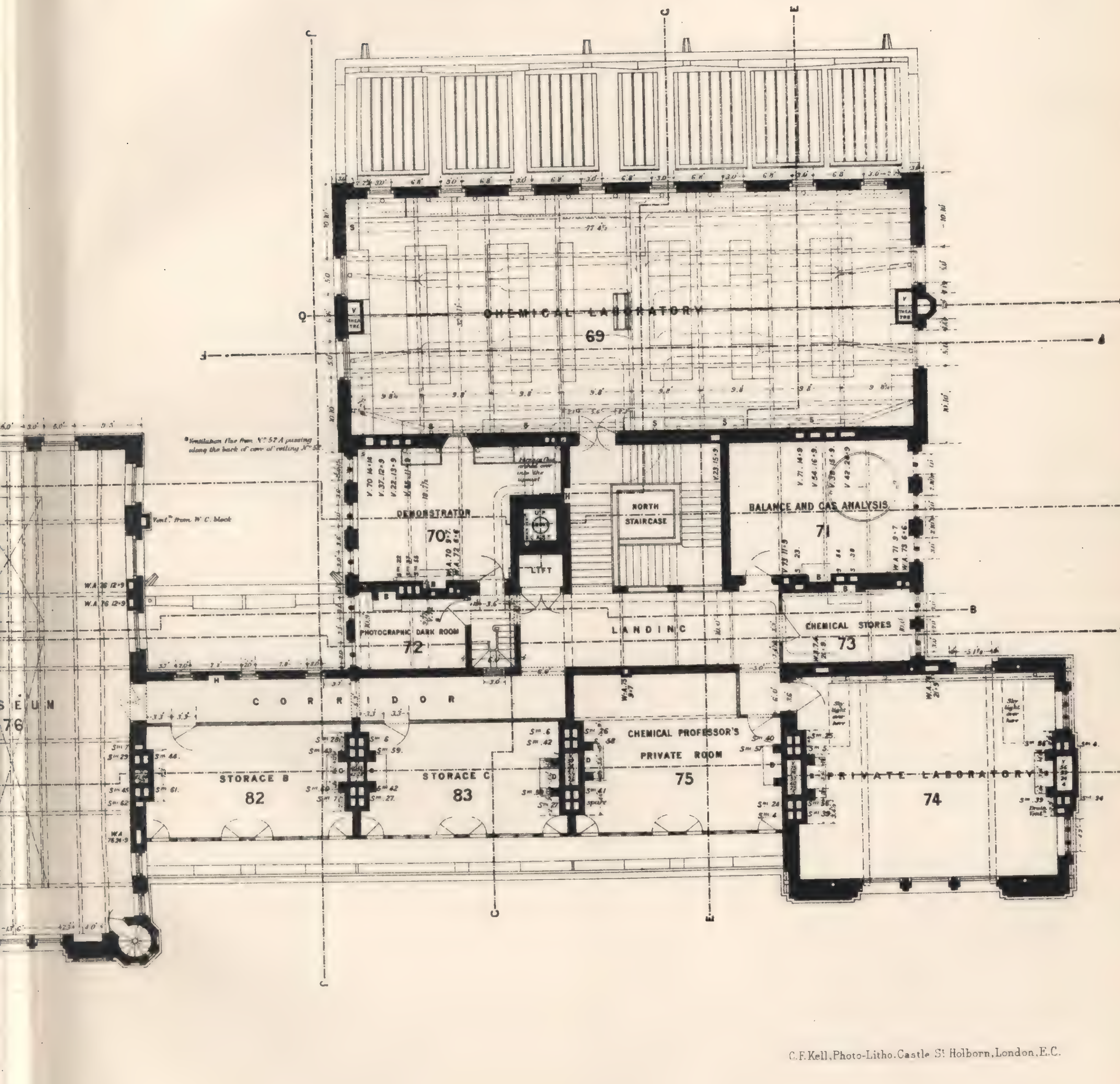
Kell. Photo Litho. Castle St Holborn, London, E.C.

THE CITY AND GUILDS OF LONDON CENTRAL TECHNICAL INSTITUTION, SOUTH KENSINGTON, LONDON.

FIG. 109. THIRD FLOOR PLAN.



Alfred Waterhouse



C.F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION (xliv)

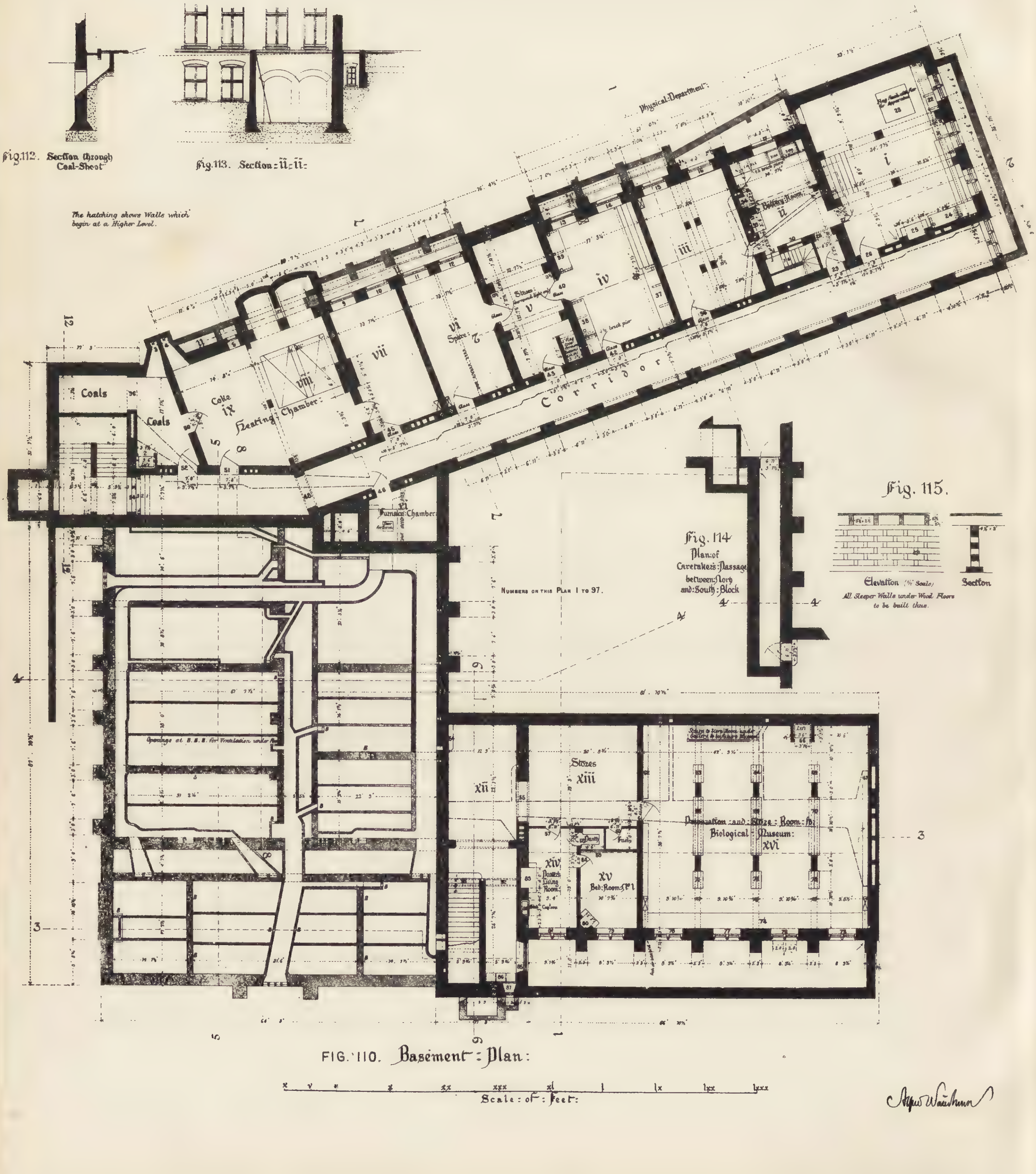


FIG. 110. Basement: Plan:

The: Yorkshire: College:
Clavering: Road: Chemical: Laboratory: and: Baines: Memorial: Blocks:
Leeds:

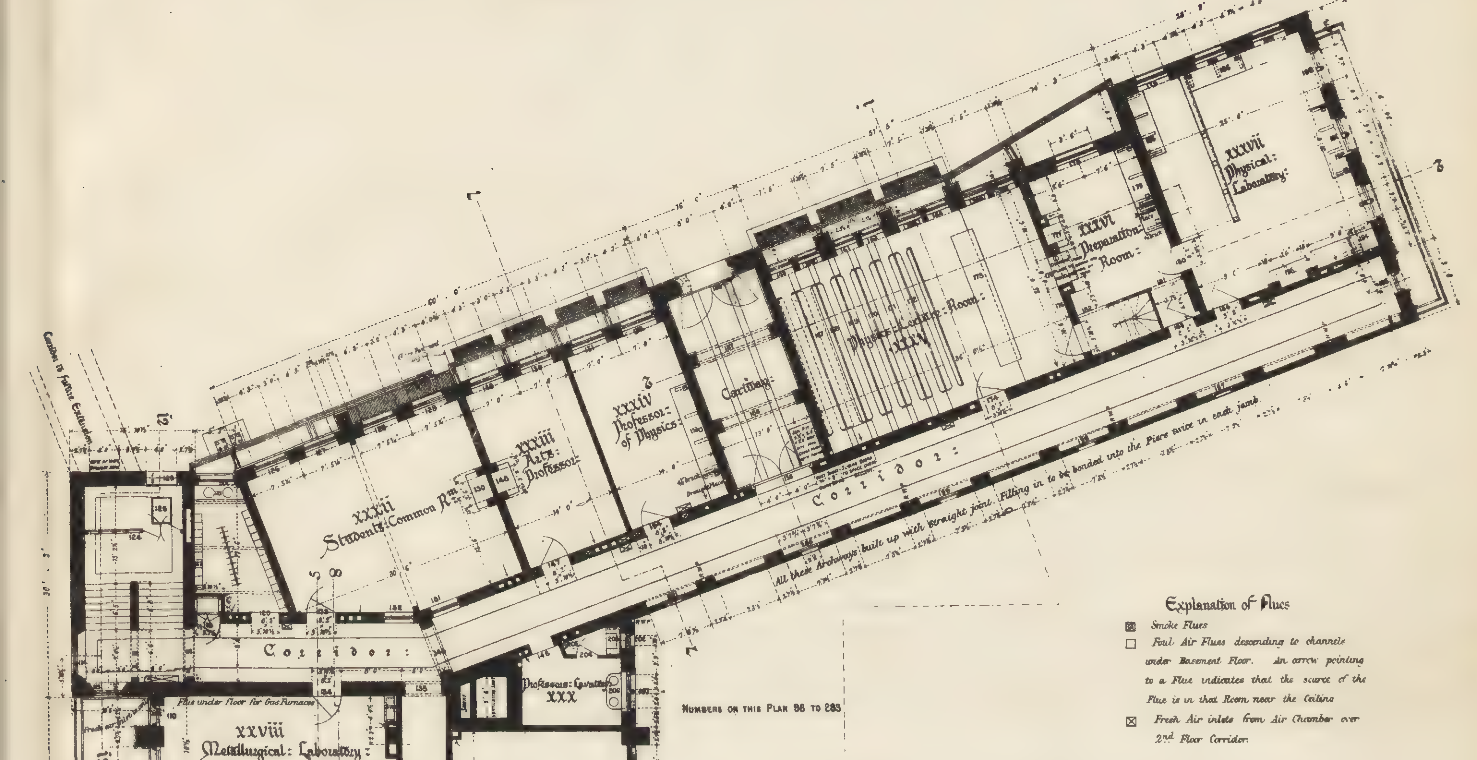


FIG. III. Ground: Floor: Plan:

x v 0 x xx xxx xl l lx lxx lxxx
Scale: of: Feet:

C.F. Kell, Photo-Litho. Castle St. Holborn, London, E.C.

VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION (xlv.)

Fig. 119. Section-8-8-

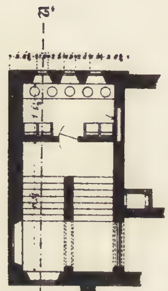


Fig. 118. Plan of the Lavatory: Mezzanine:

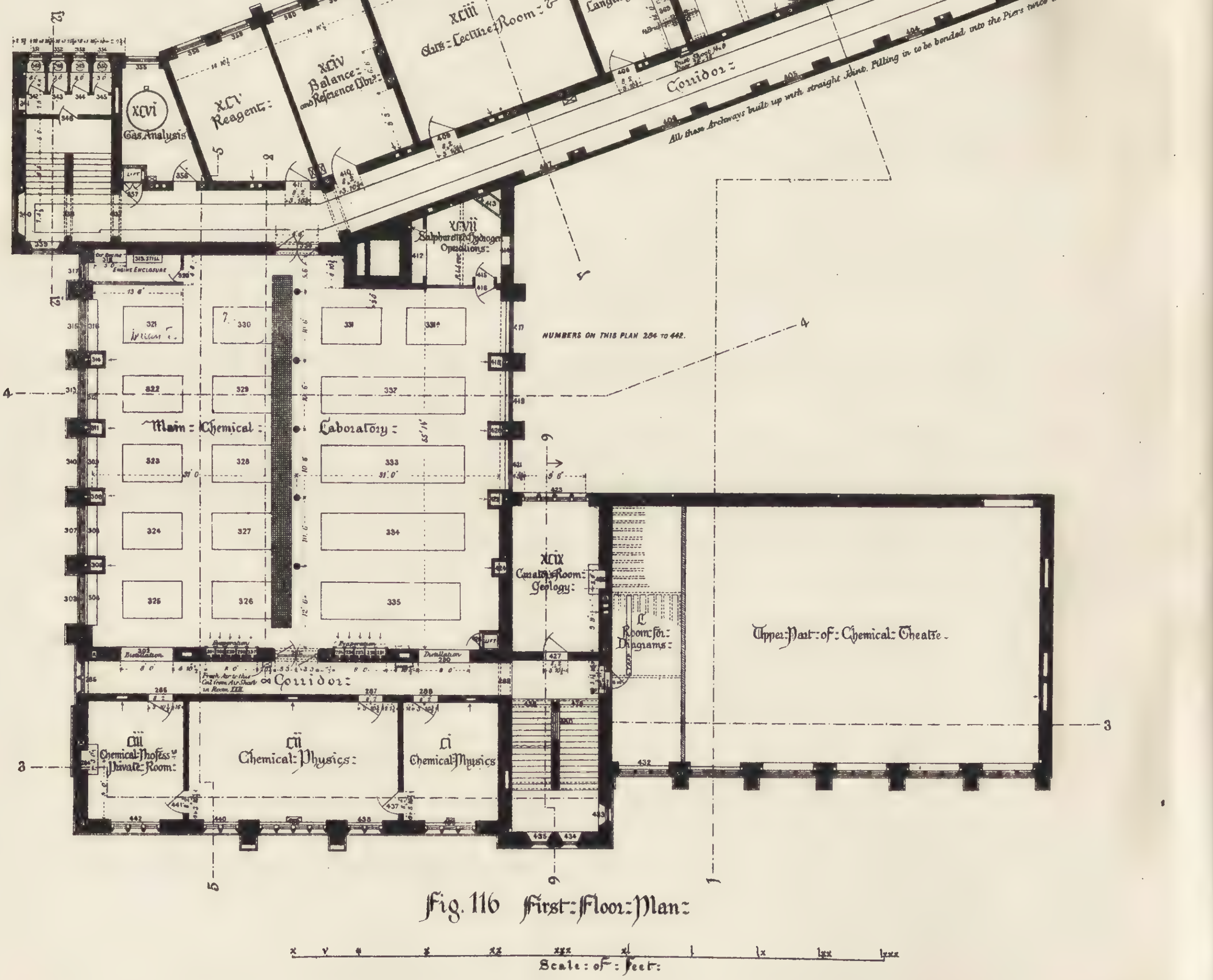


Fig. 116 First: Floor: Plan:

The: Yorkshire: College:

Clavering: Road: Chemical: Laboratory: and: Baines: Memorial: Blocks:

Leeds:

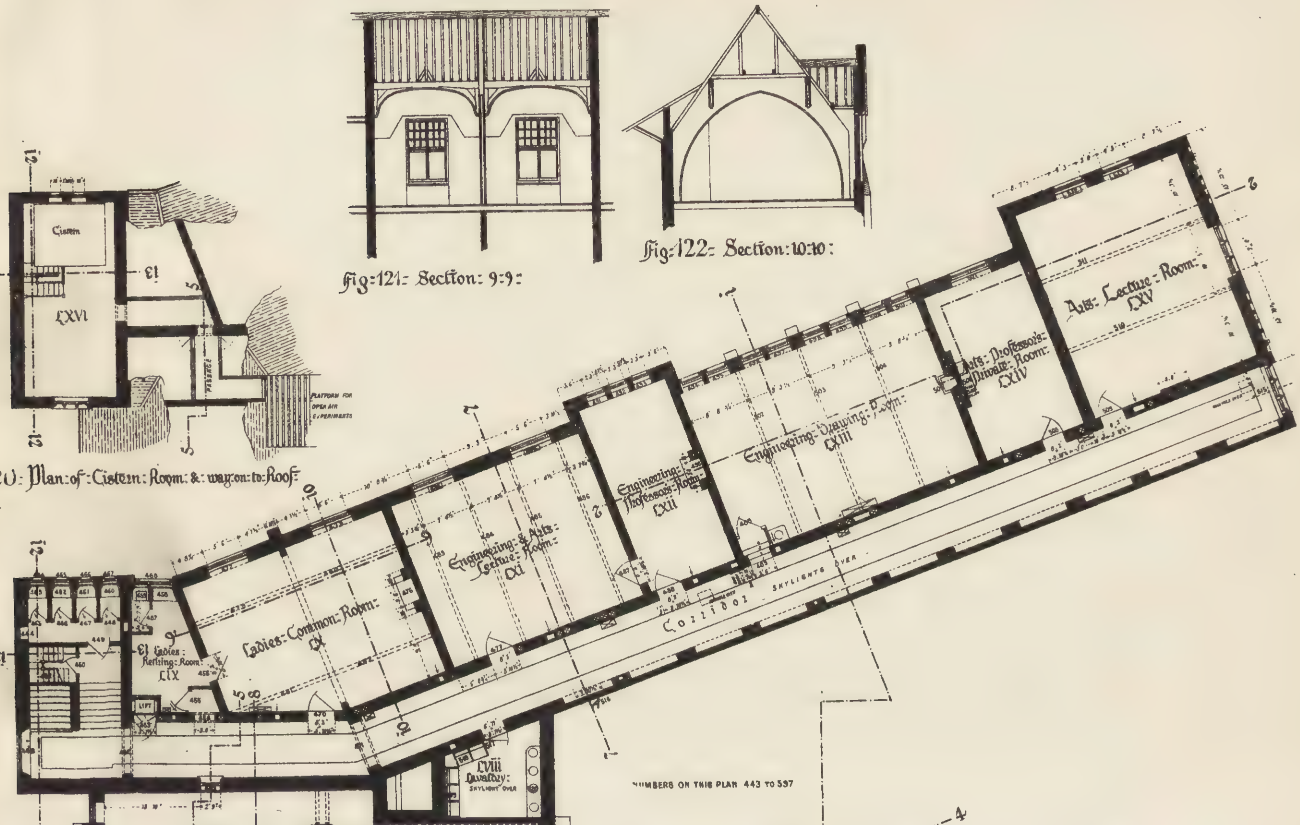


Fig: 120: Plan: of: Cistern: Room: &: way: on: to: Roof:

Fig: 121: Section: 9:9:

Fig: 122: Section: 10:10:

Fig: 117: Second: Floor: Plan:

Scale: of: Feet:

C.F. Kell. Photo-Litho. London. E.C

VII. BUILDINGS FOR APPLIED SCIENCE AND ART INSTRUCTION (xlvi)

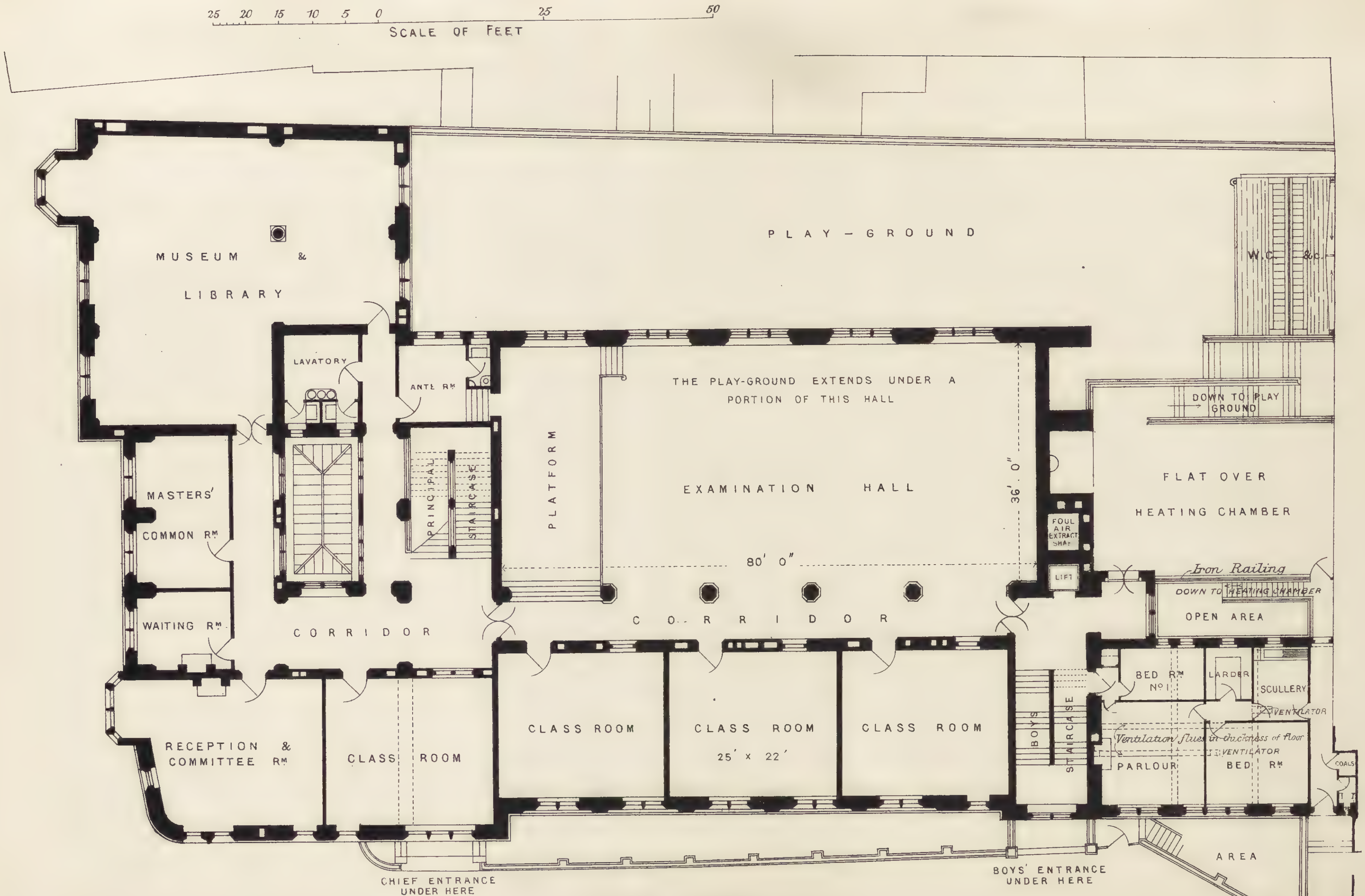


FIG. 123. GROUND PLAN.

Edward Robins.

MERCHANT VENTURERS SOCIETY'S SCHOOL, BRISTOL.

C. F. Kell, Lith. 8, Castle St. Holborn, London, E.C.

VIII. THE MOSQUE-CATHEDRALS OF CORDOVA AND SEVILLE AND SOME CONTEMPORARY ARABIC BUILDINGS.

By R. Herbert Carpenter, *Fellow*.

[Read on Monday, 19th February 1883, David Brandon, F.S.A., *Vice-President*, in the Chair.]

I PROPOSE to submit some remarks upon the great mosque-cathedrals of Cordova and Seville, neither of these buildings having been described by the late Mr. Street in his admirable work on Spain;* and the reason for so doing lies partly in the fact of my having, during recent years, visited both those places.

After the first general artistic examination of such a building as Cordova cathedral, or indeed of any other historical building, one is naturally anxious to find out all about its archæological history, but even in good guide-books one is met with statements such as, "That "prince, Abd-el-Rahman I., had determined from political as well as religious motives, to build "a magnificent mosque (at Cordova) on the plan of that at Damascus, to excel the new one at "Baghdad in splendour and extent, and comparable only to the Aksa at Jerusalem" (*O'Shea*); and the mosque of Tooloon at Cairo is described in *Murray* as "built on the plan of the Kaaba at "Mecca, which seems to have been that of the oldest mosques *founded by* the Moslems."

The impression conveyed by these statements to those who have not visited Jerusalem, Damascus or Cairo is an entirely incorrect one; and those who have (except the few who know better) might have expected to see there the buildings which Abd-el-Rahman intended to rival or excel. I will, therefore, refer to those mosques to which that of Cordova is compared, and then to the more primitive type, from which in my opinion its plan is really derived—that of Kairwan. But in order that what I have to say on Cordova may be more intelligible I will first shortly describe the earliest mosques erected, that of Mecca being of course the first, though in plan and arrangement quite peculiar. Its centre of worship, the Kaaba, is historically of "heathen" origin, but no building in the world is more ancient according to the Mohammedan doctrine, which says, that there was a Kaaba in heaven, just over the site of the present one, two thousand years before the creation of the world, and that the angels passed round it seven times in their adoration, as the pilgrims do now in the walk commanded by the Koran, and called the "towaf." Adam, "the first true believer," erected the first earthly Kaaba, and ten thousand angels were appointed to guard it. It nevertheless needed restoration after the deluge (though a tradition is that angels raised it from the earth into the air), and the necessary work of reconstruction was carried-out by Abraham and Ishmael on the original foundations. The famous black angle-stone was given by the Archangel Gabriel to Ishmael, and it was then white and brilliant; but the sins of those who touched it turned it to its present colour. The neighbouring holy well of Zem Zem was created to relieve Hagar and Ishmael, and they say the holy well of Kairwan is joined to it, and this is proved by a pilgrim's drinking-cup which fell in at Mecca being found in the well at Kairwan! Mohammed found the temple of the Kaaba full of idols, which he destroyed, and shortly after, in the year A.D. 639, the first cloisters were built and the Kaaba repaired. They were soon after burnt, rebuilt and enlarged, and the cloisters again

* See *Some Account of Gothic Architecture in Spain.* 8vo. Lond. 1865.

reconstructed in A.D. 785 on a grand scale, with Egyptian marble columns all round; then again enlarged and rebuilt in A.D. 903 and 936. Then little was done till the fifteenth century, when the Sultan Berkouk of Egypt reconstructed two sides after a fire, probably in the beautiful early-pointed style of his mosque in Cairo. The vaulted domes to the cloisters were erected by the Sultan Selim I. of Constantinople, and finally, in 1626, the whole was nearly destroyed by a torrent; the sacred walls of the Kaaba itself were thrown down and had to be rebuilt from the foundation, and the mosque and cloister then took their present form.

According to Burckhardt the Kaaba itself is a very small building; the cloisters entirely surround it, and the whole space inclosed by the outer walls forms the place for prayer. The Kaaba itself, which is but seldom opened, has one small door high up in the wall reached by moveable steps, and it is surrounded by the several separate places of prayer, all rebuilt in the seventeenth century, belonging to the four orthodox Mohammedan sects. There are also near it buildings for storing the holy water. The great white marble pulpit of 1591, surmounted by a lofty steeple, is also close by, and there are the buildings covering the holy well of Zem Zem, and the stone which acted as a moveable scaffolding for Abraham during his building operations. Raised paths lead to the centre from the many gates into the cloisters. These cloisters have pointed arches, and the outer aisle is roofed by domes rising, in Ali Bey's section, as sharp cones on the outside, but more probably as curved domes, as shown in Sale's *Koran.* The inner aisles have low domes, covered over entirely by the flat roof; some of the columns (about 20 feet high) are of marble, granite and porphyry, but most are of local stone; many of the ancient capitals were re-used in the seventeenth-century repairs, and some even are ignorantly used as bases.*

Damascus was the first great city conquered by the Arab invaders about A.D. 634. Jerusalem was taken a very few years later, and the north coast of Africa in A.D. 648. All these conquests were anterior to that of Spain, which was in A.D. 711.

DAMASCUS MOSQUE.—This mosque is a curious combination of Roman, Christian and Arabic work, and it has never yet been described in such detail as it deserves, partly on account of the danger which would be incurred through the peculiar intolerance of its inhabitants. Professor Lewis has, however, carefully examined and noted some of its features, and to these with his kind permission I will briefly allude. Originally a great Roman temple stood on the site, which Dr. J. L. Porter† says was surrounded by ranges of columns like the temples of Palmyra and Jerusalem, joined possibly to colonnades running along the principal streets. The western portico of this temple exists, as also the southern one, now incorporated into the back wall. It has not at present been made clear in what way the temple was converted into the basilican church of Saint-John-the-Baptist at the beginning of the fifth century, but probably it was rebuilt entirely on the usual basilican plan, and the northern piers next the court, which *are* the four great piers of the central transept, *may* be of this date: and portions of the southern and western walls may be of similar date. The present walls would then mark the limits of a

* See Burckhardt's *Account of a Visit to Mecca in* 1814, and Ali Bey's description and illustrations, published in 1815, in the possession of the trustees of the Soane Museum.—R. H. C.

† *Five Years in Damascus.* 2 vols. 8vo. Lond. 1855. The edifice is described and its ruins are traced at pp. 68-75 of the first volume of Dr. Porter's work.

five-aisled basilican church. The massive substructure of the "western" minaret would be of this date, if not earlier, and might have formed the campanile.

At first after the Arab conquest the Christian church was divided between Christians and Moslems, but eventually the Kaliph Walid (A.D. 705) acquired the whole and adapted it,* using the older columns and capitals and other materials of the two ancient buildings. Bearing in mind that the great object in a Moslem place of worship is the Kibleh (or Mecca direction), and this at Damascus being nearly south, the south wall of the basilica answered the purpose, and as breadth was more necessary than length, they seem to have placed the Mihrab on the side of the south transept, and to have made this central by doubling the length in an eastern direction, and to have built over this area three aisles of equal width and height, working on the older central piers and erecting a dome on them. I should mention that the Mihrab may be described as a sanctuary, from which a recess was formed opposite Mecca. In this the Koran was placed. The reader in a pulpit, often placed at Cordova inside the screened-off sanctuary (which would be called a Maksoora), led the devotions of the people standing towards Mecca under a great covered place called the Prayer-chamber, northwards of which would be the ablution court and its fountains surrounded by cloisters. The great court of Damascus is possibly on the lines of the Roman one as regards its northern side; it has pointed arches resting on columns, many of which are built-up in stone, and over them is a range of clerestory windows, now with no intervening floor, as at St. Lorenzo. The mosque has a fine range of gorgeously traceried windows towards the north fitted with rich glass, and the lower part of the walls is covered with marble; the upper part of the central portion with remains of mosaics. The plan of the mosque seems to have been enlarged from the pre-existing basilica, which seems to have been utilized as much as possible [Illustn. xlvii].

THE AKSA MOSQUE.—Referring now to the Aksa at Jerusalem, I think that it very probably occupies the site of the church built by Justinian in honour of the Virgin (I should, however, mention that Mr. Fergusson places Justinian's church on another site). The Kaliph Omar, the conqueror of Jerusalem in A.D. 636, is said to have converted the basilican church to Moslem use, and it seems to have remained structurally unaltered for a century and a half, until it became ruinous and was rebuilt. It is said that the ruinous building was narrow and long (as basilicas usually are), and that in the rebuilding the length was diminished and the breadth increased. This was no doubt the case, for the length of the basilica would be from east to west, while the length of the prayer-chamber (contrary to the usual plan) is from north to south. After many alterations the whole was remodelled and partially rebuilt by Saladin after it had again been used as a church by the Crusaders; later still many alterations have been made, and many of the columns have been built-up in the centre of heavy piers, especially in the case of some of the piers of the cupola and those next the women's aisle. The general style of the building is pointed, with arches resting on marble and stone pillars with Arabic capitals; the arches are tied at the springing with beams of wood cased over. The plan which I give is enlarged by permission of the Council of the Palestine Exploration Fund, from Major Warren's survey, and I am indebted to Professor Lewis, who has carefully examined it, for most of the information which I possess concerning it [Illustn. xlviii].

* Sir Gardner Wilkinson referred to this in his Paper on *Saracenic Architecture* in the TRANSACTIONS, 1860-61, page 218.

Kairwan Mosque.—Until the recent annexation of Tunis by France this mosque was quite as sacred from so-called infidel profanation as that at Mecca is. Indeed, when Mr. Rae visited the mosque, he was quite unable to do more than glance through the doorways into its interior, and while taking some few notes of the exterior he was under the protection of a guard of soldiers sent by the Kaïd; but notwithstanding all these difficulties, he got at the main features of the mosque with wonderful correctness, being confirmed by Mr. Alexander Broadley, who, in his interesting work, *Tunis Past and Present,* gives a most careful plan of it from French measurements, and equally careful notes from his own observations. This plan of the mosque of Kairwan, by his father's (the Rev. Canon Broadley) kindness, I am allowed to reproduce for comparison with those of Cordova, the Aksa and Damascus, and, while referring anyone specially interested to the book itself, I will describe some of the peculiar features of this mosque, which has grown from small beginnings [Illustn. xlix].

The earliest building was founded by the Emir Okhbah, about A.D. 675 (or in the 55th year of the *Hegira*). He most carefully calculated the position of the Kibleh; he erected the Mihrab and a mosque, and this Mihrab still exists, having been spared through all the successive rebuildings of A.D. 691, 727, 777 and 827. In this last rebuilding, however, a wall was built across it, thus shutting it out from the prayer-chamber, and it now forms the private entrance of the Grand Mufti—the spiritual governor of Kairwan—and opens into the Maksoora by the side of the present Mihrab. The plan of the mosque is rather irregular, as it is wider at the south-eastern end than at the other, being respectively 255 feet and 225 feet, the length of the sides being equal, or 427 feet each. The prayer-chamber has a wide central aisle, with eight aisles of eight bays on either side; all open by archways into a double-aisled northern cloister 30 feet wide, which returns round the other three sides of the court. The prayer-chamber is 255 feet wide by 120 feet long (outside dimensions). The chief entrance to it is on the western side, and is carried-up as a tower; it has a lofty outer arch, supported on columns, with a blank wall-arcading on the upper storey. There are four other smaller gate-way-towers on each side of similar character, but of simpler treatment. At the north-western end of the court is the Minar, 30 feet square, a massive tower of three graduated stages surmounted by a small dome; a staircase of white marble is carried-up the centre, and it contains many Roman fragments of the time of Trajan and Aurelius Antoninus.

The central entrance to the prayer-chamber is opposite the Minar, and is very lofty and surmounted by a circular fluted dome and drum on a square base; the entrance arch is horse-shoe shaped and rests on rich marble fluted pillars, and has doors inlaid in rich and elaborate patterns. The roof of the vestibule is higher than that of the cloisters, but not as high as the roof of the prayer-chamber. The front arches of the cloister are slightly horse-shoed and rest on coupled columns of grey marble, backed by a heavy stone square pier; the inner arches rest on double and single columns. The prayer-chamber has its arches supported on columns 22 feet high in the central and 15 feet in the side aisles; in the central aisle the columns are in pairs, or three together in special places, where arcades run in both directions in the aisles.* The southernmost cross aisle has also coupled columns, of white and black marble (now whitewashed!), with apparently Roman-corinthian and composite capitals; some caps

* There is a similar arrangement in the Azhar mosque in Cairo, and I make a further reference to this mosque in my concluding remarks on Cordova cathedral, at page 113.—R. H. C.

are, however, byzantine, and are carved with birds and flowers. The arches are tied together with beams of wood and iron rods. In the central arch, cloister and vestibule there is a rude entablature between the capitals and arches, but in the aisles the stilted semicircular arches spring at some height above the capitals with the square impost and corbelling forward between, which seems an adaptation of the outline of the old entablature, and possibly was the beginning of the horse-shoe form of arch. The Mihrab is surmounted by a fluted dome on a hexagonal base, containing richly coloured glass windows; it rests on groups formed of four columns. On each side of the arched recess for the Koran is a red porphyry column, taken from a Christian church, and for these columns it is said that an emperor offered their weight in gold; the recess is lined with byzantine mosaic and lapis-lazuli inlays; the pulpit is of dark wood with elaborately carved panels, with a long flight of eleven steps; the bays adjoining are screened-off with richly carved woodwork of a similar character, forming the square Maksoorah shown in the plan. The pavement is all of broken white marble and stone; the roofs are of dark coloured wood and at a flat pitch. The number of columns inside and outside the building as counted by various writers seldom agrees. An Arab writer in the eleventh century gives 500 as the number, and according to the French plan there are now 501, though Mr. Broadley gives 439 as the total, and Mr. Rae 435.

Cordova Cathedral.—Famous both for its very considerable architectural and artistic merits, and also for being the only surviving building in Europe of the primitive style of the Moslem places of worship, the mosque-cathedral of Cordova now claims attention. In the year A.D. 711, or 89 of the *Hegira*, the great Moorish invasion of Spain took place which supplanted the old gothic kingdom after its existence of two centuries and a half. The invaders were headed by Tarik, a warrior of the city of Kairwan, who was in a short time joined by the Emir Musa, afterwards the conqueror of Seville. Cordova having fallen to the arms of the Tarik in the course of that year, the Moors at once entered into possession of it. We learn that there was in the city, on the site of a former temple of Janus, a large church dedicated to San Vicente. This church was probably built from the materials of the temple, and was divided by the conquerors with their usual liberality between the Christians and themselves. They then commenced to erect on the site of their portion a place for their own worship; this was but small, and they were obliged, as the number of settlers increased, to add to this nucleus aisle after aisle, each one of which had its roof lower than the one immediately preceding it, until (it is said) the outermost aisle was so low that people could not stand upright in it. This mosque, however, served their purpose till A.D. 786, when Abd-el-Rahman declared the independence of the city and himself as its Kaliph. He then with some difficulty bought the Christians' remaining half of the former church, and, pulling it and the old mosque down, commenced the great building now existing. [Illustn. 1.]

The founder's intention (as one is generally told) was to erect a mosque at Cordova exceeding in grandeur and beauty the then existing mosque at Damascus, the Aksa at Jerusalem, and even that at Mecca itself. I have referred to the plans of each of these, and I think it evident that the founder of the mosque at Cordova had that of Kairwan in his mind when he started his great work.

In the course of the next two centuries the population of Cordova required still more space for worship, and El Hakeem II, in A.D. 961, set to work to enlarge the mosque.

El Hakeem* formed arches through the southern wall, and carried on the eleven aisles for twelve more bays further south (as indicated by the black hatched lines in Illustn. 1); he of course rebuilt the Mihrab, and erected several priests' chambers storeyed on each side of it, extending the whole width of the building. The northern front then opened by arches corresponding to each aisle into the front court, most of these probably being screened with wood lattice-work. This court was rebuilt about A.D. 937, when an entrance tower, the lower part of which still exists, was erected on the site of the more ancient one, opposite to the principal aisle. The present cloisters are probably thirteenth-century work, executed by Moors.

Again in A.D. 981, or perhaps a little earlier, further considerable enlargement became necessary, and the then Kaliph, El Mansour, commenced the portion indicated by the red tint on the plan [Illustn. 1]; he also cut arches through the whole length of the eastern wall (the steep fall of the ground towards the river preventing extension in that direction), and he added eight aisles of thirty-six bays in length, and continued the front court eastwards to correspond with the increased width. This court contained the marble ablution cisterns placed there by El Hakeem II, who supplied them with water direct from the mountains. The present beautiful avenues of orange trees within the court did not then exist; they are believed to be not earlier than the sixteenth century, and they are planted around the old fountains. In this form the mosque existed till the city was captured by the Christians under St. Ferdinand, King of Castille and Leon, in 1235, and after this period the Moors became vassals to Spain under the rule of Ibn-el-Ahmar. It is very probable that the Christians suffered the Moors to retain a portion of the mosque, while they on their part at once set to work to make the alterations they considered necessary for worship, and when these were completed they dedicated the church to the Virgin.

As far as I can learn very little notice has been taken of the important changes effected in the thirteenth century. Writers mostly content themselves with referring to the alterations of the sixteenth century, in the time of Charles V, and I will therefore further on draw attention to the former. On the examination in detail of the founder's work, in A.D. 786, we find that he followed the then general practice of re-using old marble pillars, and the adoption of the form of the round arch. These pillars he got from the locality; probably many came from the ancient temples of the city, which had in turn been utilized by the builders of the basilican church and of the first mosque; others came from Seville and Tarragona, Nîmes, Narbonne, Carthage, and even from Constantinople, and all of them are of the choicest marbles, varying in height and diameter. Some are partially buried, while others are underbuilt with stone to make them fit; some are fluted with upright and spiral flutes. None of them have bases, but all have ancient capitals of very beautiful Roman and Byzantine workmanship. With regard to colour in the marble pillars there is only purely a haphazard arrangement, but the effect, owing to the beauty of the material, is very rich. The pillars support slightly horse-shoe-shaped semicircular arches—one row over the other so as to gain height—the upper arches being semicircular, and of course those which carry the weight. They are now covered with whitewash, but where a portion has fallen off it can be seen that

* This El Hakeem should not be confounded with the Sultan El Hakeem of Egypt, who built the great mosque in Cairo, bearing his name, in A.D. 1003, and also restored the mosque at Mecca. Cordova was independent and had its own Kaliph.—R. H. C.

the arches are constructed of rubbed brick and stone in alternate voussoirs. The old wooden roofs are now hidden by brick and plaster vaults, and the original pavement which is said to exist is covered by common red bricks.

The southern addition, made by El Hakeem II, is carried-out in the same style as that of the eighth century, but there does not appear to have been any available local store of old marble pillars and capitals. The pillars then used are said to have been brought from Merida, and are of nearly uniform height and diameter; they are arranged alternately in red and black marble, and counterchanged on opposite sides, so that a diagonal view gives all red columns on one side and black on the other. They have no bases, and the capitals are only carefully blocked-out to the forms of the Corinthian order, but not, I think, in any instances finished, excepting the upper ones in the screen-work of the Mihrab. The arches are in a double row of brick and stone; the upper series is thicker than the lower, the additional thickness resting on a pilaster on each side supported on a corbel worked on the solid stone springer of the lower order. These corbels have a curious resemblance to that peculiar French corbel shown by Viollet-le-Duc, which is derived from the effect produced by cutting a block of wood into successive curling shavings. In the central aisle the pilasters are of stone, some octagonal in plan, most richly wrought into diaper and fluted and panelled patterns, supporting beautiful byzantine-like foliated capitals, on which the woodwork of the old roof was supported. Now, the plaster vaulting-pilasters and vaulting rest on them, interrupting the original richly moulded red brick cornice and inscriptions.

The original number of doors is uncertain, as many are closed and some blocked and plastered over. One authority says there were twenty-one, and another only nine, but it is evident there were a great many doors opening on the east and west sides, as well as into the court, and that one of the doors on each side opened into the former, which were women's recesses, formed by screening or walling-off some of the outermost bays, as is done at the Aksa, at Jerusalem. These doorways have flat lintel-heads with relieving arches over of brick, stone and marble richly carved. Most of them have a small double recess on each side, of a beautiful description, with a large single-light window over. These windows are, I think, nearly all blocked, but some of them are still filled with the peculiar Moorish pierced stonework formerly containing stained glass. At the south-east end there was one door reached originally by a covered passage from the palace of the Kaliph (which I believe occupied the site of the present episcopal palace on the west). This door opened into the Maksoora (or screened-off portion), close to the Mihrab, as at Kairwan. This door and all the others were covered with Andalusian brass, and one of these original doors still exists at the entrance to the court. The Maksoora formed a sanctuary; the two bays all across eleven of the aisles were screened-off from the rest. The central aisle had also a screen formed by three triple interlacing cusped arches of carved white marble, resting on slender marble pillars, of similar design to those in the beautiful chapel at the western end of this same aisle. There were three elaborate doors in the screens, and within the Maksoora stood the Mimbar, which was a pulpit, made of ivory, precious woods and stones. The Mihrab was of course at the south-eastern end of the central aisle, and out of it opens a recess nearly circular on plan, in which the sacred copy of the Koran was kept. This recess or niche is covered by a marble shell-shaped dome, and its walls have cusped arcading and bands and carved patterns of white

marble with exquisite byzantine mosaics filling the whole space. They are as perfect as when put up by the workmen, who were sent by the Emperor Leo from Constantinople, at the Kaliph El Hakeem's request. The floor is marble; the walls, arches and dome of the Mihrab are also covered with these very beautiful byzantine mosaics, which of course are confined to foliated or geometrical ornament. The dome rests on eight intersecting pointed-arched ribs supported on marble shafts, between which are cusped openings. The roofs of the whole mosque* were originally of wood called alerce (the arbor-vitæ), and in one of the side chapels portions can still be seen decorated with red, green and black, with some gilding.

Here, in the tenth century, Arabian architecture, it seems to me, exhibited a peculiarly masculine grandeur and beauty which it did not possess in later centuries, however beautiful its then development undoubtedly was, as witness the Alhambra and the Alcazar of Seville. The style of this early period is based on the Roman and byzantine originals found by the Arabs in all the countries (except India) which they invaded, but in each country the style developed itself in various ways, and in later days there was little in common between the many Arab countries. The later Arab architecture of Spain differs as much from that of Egypt, or Syria or Constantinople, as gothic buildings in England differ from those of France, Italy or Germany. In the great eastward extension by El Mansour, though commenced within a few years of the completion of El Hakeem's work, there is a falling-off in art: the general style is adhered-to, but the pillars are in some places irregularly spaced, and some of the arches are pointed, while the majority are semi-circular; the pillars are irregular in size, mostly of black marble, and the capitals are very coarsely blocked-out. All the walls and arches are now covered with whitewash, as are the plaster vaults, but if a cleansing process were adopted, the effect of these long aisles would, notwithstanding their irregularity, be very noble.† The cloister of the front court has bays of three stilted semi-circular arches resting on columns with capitals like those of El Mansour's work; the piers between are square, with a curious form of buttress, semi-circular in the plan in the lower stage, and half hexagonal in the upper. The northern cloister is nearly all filled-in with modern walling, and the cornices and roofs are all modern. With regard to the alterations made by the Christians it will be noticed that a great chapel was formed by the destruction of eighteen divisions of El Hakeem's work. Its design is simple and poor in character; the piers carry pointed moulded arches with a lofty clerestory rising above the older roofs, each window of which is of two lights. But the greatest alteration made was the intrusion of the *coro* in the thirteenth century, or beginning of the fourteenth, and of the *crucero,* transepts and *capilla mayor* in the sixteenth century. In the *coro* there are many traces of thirteenth-century work, especially in the

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* Mr. Fergusson thinks that originally the interior may have been lighted by an open arcade or clerestory in the upper part of the external side walls, but I could see no traces of it nor of any windows except those before mentioned. It is recorded that on festivals there were ten thousand oil lamps in the numerous chandeliers, and it is probable that there was ample light by artificial means.—R. H. C.

† I may here mention that the cleansing of El Hakeem's work was done at the cost of the late Bishop of Cordova, who spent large sums on this work of restoration. His example is being followed by the present Bishop, who just before my last visit had cleared away some modern altars in the classic style. He has also opened-out the rich marble and mosaic screens, the dome and arches of a most beautiful chapel of the tenth century, which are to be carefully cleaned and preserved. This chapel was possibly the Maksoora, used as a place of prayer by the Kaliph.—R. H. C.

windows of its clerestory, which can be seen high above the old roofs. They were of two lights, and resemble the work of Burgos cathedral, which was going on at the same time. The arcades also have remains of the same date; but the *coro* was so mutilated by Hernan Ruiz, between 1523 and 1529, in the plateresque style that, except by careful examination, the whole appears later than it really is, though the outer roof possesses its old high pitch.*

The *coro* stands on the site of the old church of San Vicente, and it was in 1547 that the Chapter obtained the permission of Charles V, who rejected the conservative petition of the citizens, to enlarge the structure by adding the *crucero* transepts and *capilla mayor*. They are designed in a combination of late gothic and plateresque, and great ingenuity has been shown in the treatment of the arches of the transepts where the Moorish aisles run into them. The effect of the whole is undoubtedly very grand, and is magnificent in proportion, though its details are open to criticism; and one cannot but respect the skill of the architects, even though its erection involved the sweeping away of a large portion of Moorish work. Concerning this destruction the Emperor Charles V is reported to have indignantly exclaimed when he visited the newly completed work, "I was not aware of this, had I known you intended to touch the "ancient portion I would not have permitted it. You have built here what can be built "anywhere else, but you have destroyed what was unique in the world"; and I think we must all of us agree with him. I should not omit to mention the very clever and artistic treatment of the great internal piers of the flying buttresses. These, and the walls of the *capilla mayor*, facing the aisles, are panelled and filled with sculpture of late-pointed work, executed with great delicacy and beauty.

All the external aisles are now screened-off to form chapels, these alterations having been made from time to time. In 1713-23 the brick and plaster vaulting and skylights of plastered brickwork were introduced, but possibly not at first over the whole area, for it is recorded that "the carved and painted work of the wood called alerce was cleaned and restored by Patricio "Funiel in 1816." This is referred-to by Gwilt (in the 1854 edition of his Encyclopædia) where he quotes from the same authority, "the decorations throughout are in stucco, painted of "various colours, decorated with legends and occasionally gilt like churches of the lower "empire." Alas, no such decoration is now to be seen, and those who barbarously whitewashed the interior have much to answer for; yet it is to be hoped that the good work started by the late bishop may be continued till all these hidden treasures come to light again.

About the exterior there is not much to say; no Moorish building was ever built for external effect. The walls of court and mosque form but one long line of plastered *tapia* or rubble work, with a cresting of the ancient "flame"-shaped battlement and modern variations of it. Tower-like buttresses are carried-up square, with the parapet and cresting returned round them. None of the old roofs are visible, but the outlets of the gutters are through the buttresses, with quaint gurgoyles. There rise from the level parapet line only the cupola of El Hakeem's Mihrab and the chapel and cathedral clerestory and dome. The bell tower is, however, a fine feature with its panelled brick Moorish basement and rich plateresque upper storeys, with the numerous bells hanging in the open arches, crowned by a great gilded figure of St. Raphael.

* Luckily the Moorish work, where not disturbed, suffered little in those days, for in 1275 Moorish workmen were engaged and retained on the cathedral staff to keep the ancient work in repair.—R. H. C.

Seville Cathedral.—At Seville, contrary to Cordova, there is but little of Moorish and much of Christian art. Both cities were closely bound together in their history. Seville was an ancient Phœnician port, and afterwards, in Cæsar's time, it was founded as a Roman city, when its site was at Italica, a short distance away, on the other side of the river Guadalquiver. At Italica are to be seen the remains of a magnificent Roman amphitheatre, but it is not at present properly excavated, four men and six mules only being employed. There is much yet doubtless to be discovered. This old city then held by the Goths was conquered by the Moors under the Emir Musa, acting under the orders of the Kaliph of Damascus, just after the capture of Cordova by Tarik. The son of Musa, Abd-el-Aziz, was the first governor of Seville, and he no doubt erected the fine mosque, in the early years of the eighth century, on the model of that at his native place, Kairwan; and this he did, it is said, on the site of a Christian church of San Vicente, which had taken the place of a Roman temple to Venus. If this be the fact, the Roman and Gothic cities must have occupied both banks of the river, for the Moors abandoned Italica and built at Seville only—Italica becoming a quarry and remaining so to the present time. The primitive mosque existed till 1184, when it was burnt down during an invasion by the Normans. It was then at once rebuilt by the Emir Yusuf, and a small portion of this mosque yet remains, as well as the court on the northern side of the cathedral, and the beautiful minaret built by his son Yakub-el-Mansour. This tower is now known as the Giralda. In a few years (in 1248) Seville was captured by St. Ferdinand, King of Castille and Leon, when the mosque was converted with many alterations and additions into a Christian cathedral, the Moors retaining a portion of it for their worship and schools. In 1480 the whole building, after seven centuries of use, had become ruinous and was nearly all pulled down. On 18 July, 1401, the Chapter met, and passed a resolution to build a church, to be "so large and beautiful that coming ages may proclaim us mad to have "undertaken it." They began their work by subscribing most liberally themselves, and aided by other contributions the cathedral was practically completed and consecrated in 1519. It appears to me to be one of the very grandest buildings ever erected, and it is, I think, rightly distinguished from the other great cathedrals of Spain by the epithet *grandeza.*

The site of the mosque admirably adapted itself to the site of a cathedral. The exact orientation not being considered essential, the south-east wall of the mosque formed the boundary on that side—the apse being continued beyond the eastern line, defined by the east wall of the court. The south-western boundary was also fixed by the court. The northern wall of the cathedral is on the site of the mosque wall, of which the entrance-door remains, called the Puerto del Largarto (from a stuffed crocodile hung over it, and said to have been sent by the Sultan of Egypt to the King of Spain, with a request for the hand of his daughter, a request which was refused). The Moorish court with its original ablution fountain, and its rich northern entrance doorway, called the Puerta del Perdon, with its old bronze doors are still preserved. Passing through this there is a grove of orange trees, over which rise the beautiful Giralda tower, 350 feet high, and the great mass of the cathedral with its unfinished transept front. The great tower is built of brick, treated ornamentally on the outside. It was used as a minaret for the calling of the faithful to prayer; there is an incline formed in a passage all round the walls, as at the tower of St. Mark, at Venice. The present top belfry-storey replaces an older one, which was surrounded by four great golden balls; this storey was added-on by Fernando

Ruiz, in 1568, and is most successfully adapted in its proportions to the older work, the apex being formed by a female figure representing " Faith," which turns as a weather-cock, hence the title " Giralda." Within the mosque-area the architect set-out the building with a central nave, two side aisles on each side, and side chapels between the buttresses. The original east end was square on the line of the mosque boundary, and this square east end was adopted at Salamanca, contrary to the original plan by Hontañon, who came there from Seville. The *capilla real,* which gives an external apsidal effort, is of renaissance-work of 1541; the central aisle is 56 feet wide from centre to centre, and the side aisle 40 feet. Mr. Fergusson points out a curious feature in the setting-out, that the diagonal distance of a compartment of the aisle is equal to the width of the nave, just as is found in the Indian Jain temples. The height of the nave is 134 feet, and of the aisles 96 feet; and the dome over the crossing 158 feet (Seville feet).

Excepting the unfinished west end and transept the fifteenth-century design is complete, but it is now much encumbered by later additions in the form of sacristies and chapels. The arrangements are, as usual in Spain: a *coro* in the nave, and one bay of what we should call the choir is the *capilla mayor* with the high altar; and both are separated by magnificent brass screens from the central open space under the crossing. The reredos is a most magnificent erection reaching to the springing of the vault; it is of alerce wood, and the work of the early part of the sixteenth century. Behind it is a sacristy with a Moorish ceiling, and then the ambulatory; the added *capilla real* projects to the eastward. In the centre of the second bay from the west is the grave of Ferdinand Columbus, the son of the discoverer, and on this in "Holy" week is erected a gigantic wooden tabernacle called the " Monumento." It is of sixteenth and seventeenth century design and execution, and used for the reception of the Host over Good Friday. Externally the original effect of the cathedral is quite spoiled by the renaissance additions, and like other buildings of this date in Spain, there is no visible roof, the east walls having the parapet returned level. The vaulting is supported by massive flying buttresses and pinnacles, and the back of the vaulting, which is of simple quadripartite design, is paved with stone down into the pockets where the water is discharged on each side of the buttresses. There is a massive wall carried across each bay finishing level with the parapet. That this is original there is no doubt, for it seems that the vaulting of the crossing and the adjoining bays fell in 1519, and it was rebuilt in a most rich style by Juan Gil de Hortañon, who, as Mr. Street says, carried-out the designs for Salamanca cathedral designed by Alonzo Rodriguez, the " maestro " of Seville cathedral, and who also designed and carried-out Segovia cathedral. The vaulting of the crossing is higher than the others, and between are three windows, the sills of which follow the curved line of the back of the lower vaults. This is a singular feature, but it proves that the stone covering of the vault is ancient; the windows are filled with rich sixteenth-century glass, and light up the dark interior in a most beautiful and artistic way.*

* At Seville cathedral it is impossible to sketch, though my friend Mr. Jarvis and myself strove unsuccessfully for three days to be allowed to do so. We applied to the canon in residence, then to the bishop, then to the " maestro," then to the dean : all without success. Then an English resident (who is also a Spanish marquis), having invited the dean to dinner, obtained leave for us; and the next morning we began, but were immediately stopped by a passing canon. Our permissions were rescinded until a chapter-meeting could be held. We regretted this the more, as the interior is too dark to be successfully photographed.—R.H.C.

Mr. Fergusson puts Seville cathedral on a par with that at Milan, and considers they are both the work of French and German architects. As regards Milan, German influence is paramount in the design; in Seville I venture to think it is entirely absent, and so is French influence. There is a general resemblance between Milan and Seville, but there is no comparison whatever to be maintained between the one and the other in the art displayed. Milan is an ill-proportioned extravagance and offends against all rules of architecture, while Seville in its proportions, in its purity of detail, in its suitability to the climate, in its eminently artistic effect of colour, light and shade, is a perfect masterpiece of gothic art. The architect of the building, I venture to assume, was no more a foreigner than the architect of the glorious cathedral of Barcelona, or the architects of the magnificent cathedrals of Salamanca and Segovia, where, notwithstanding the over-richness of the style, the proportions are most imposing, and, as Mr. Street described them, "full of the awful solemnity which even the latest "gothic architects in Spain knew how to impart to their buildings."

The great feature in Seville cathedral is the height of the piers and the fact that, while all are on the same plan, all are equal in height for both nave and aisles. The same diameter of piers for nave and aisles alike is adopted in the great French-designed cathedral of Toledo, but the piers of the nave are more than double the height of those between the outer and inner side aisles, a fatal defect in this fine cathedral. There is the same defect at Bourges cathedral.* The French-designed cathedrals of Toledo and Leon utterly failed to grasp the conditions of climate. They are nearly all window, and notwithstanding their magnificent glass, the result is overpowering. Many of the windows were afterwards blocked-up; at Leon, indeed, only the tracery of the aisle windows is now open, and four of the six lights of the clerestory. At Seville and Barcelona the great architects of the fourteenth and fifteenth centuries gave just the right amount of light. At Seville there are small narrow windows in the aisles and small clerestory windows, high up in the vaulting, all filled with deep-toned glass; at Barcelona the same thing occurs, except in its unrivalled apse, where there is a double row of windows in and over the ring of chapels, with small circular jewel-like windows in the clerestory. Salamanca follows the type of Seville. The stone used at Seville is dark brown, something like the present colour of that at Westminster. It is the same at Barcelona, and the rich dark effect of both interiors—so dark that the fittings can hardly be seen—is enhanced here and there by gleams of light from the stained glass, and from the open door, producing results of the very highest order of artistic excellence.

On comparing these different buildings with each other it is evident that the plan of the mosque at Mecca has formed no guide for any other building either in form or style. The conditions under which it was built were quite peculiar, it was *the* centre of worship for the Mohammedan world, the place of the shrine itself, the Kaaba; and all around was the place for worshippers. These were confined, at first simply by a boundary wall, and then by covered

* Mr. Street, in his work, gives a translation of the document issued in 1580 by the then "maestro" of Seville, Alonzo Rodriguez, in which the exact proportions of the piers, buttresses and walls for the new cathedral of Salamanca are laid down for the guidance of the *Junta* of architects. There is little doubt that these are on some then-known system of design. They are very like those carried-out at Seville itself, and show that these points were then most carefully elaborated and determined by some rules, of which we are now unfortunately ignorant.—R. H. C.

cloisters, which were again and again enlarged. At all other cities of the Moslems the Kibleh (or direction of the Kaaba) was the all-important condition to be observed in building a new mosque or altering an old building for their purpose; and the Kibleh being fixed, sufficient shelter from the sun for worshippers had to be provided. When the Arabs settled on a new site, the simplest plan was, after fixing the Kibleh, to build sheds or aisles side by side—surrounded by walls—with an open walled court for ablution purposes. At other places some existing building might be available, but as a basilica ran east and west, and as the Kibleh of a mosque required to be south when north of Mecca, and south-east in the southern parts of Europe, the basilicas could only in some places be retained or altered. In other places the basilicas had to be swept away, as the difference in angle between east and south-east made it impossible to make use of them. An exception exists at Constantinople, where the glorious church of St. Sophia was spared, and the compromise now existing was arranged. At Jerusalem and Damascus the south aisle wall of the basilicas very conveniently became the Kibleh wall of the mosque, with more or less alteration to the building. At Kairwan there was no building existing, and Okhbah, having fixed the Kibleh, built his aisles side by side. The natives of Kairwan, conquerors of Spain, found a church existing at Cordova, but they had to clear it away, as its south wall did not suit their south-east Kibleh. They then followed their own type of plan, and kept to it through all their rebuildings. And when the Arabs of Kairwan, under their General Gowher, captured Fostat (old Cairo) in A.D. 973, and founded El Kahirah (the present Cairo), the mosque of Azhar was founded and erected by that General in A.D. 981, on the general type of the plan of the mosque of Kairwan. It has been rebuilt in after centuries, but the proportions of its original plan are preserved.* The older mosque of Tooloon, founded in A.D. 679, is more like that of Damascus, and its aisles run across it instead of in the Kibleh direction. The mosque of El Hakeem resembles that of Tooloon, but the mosque of Amrou when rebuilt (as it is now) followed the Kairwan type of plan. Therefore, the mosque of Kairwan is, I think, most valuable historically, as being the model of buildings in countries so wide apart as Egypt and Spain, for in both countries its influence can be seen. In these ages, as in other ages before and after, there was undoubtedly much emulation, each great city trying to build better than its rivals far and near, but Cordova was able with its immense wealth to excel all others, not only in vast dimensions, but also in the richness of materials and decorations—working-out in increasing grandeur the primitive idea or principle of the mother mosque of Kairwan.

[Remarks by Mr. Francis Percival.]

I have lately visited the Holy City of Kairwan, accompanied by Professor Sayce, and have had an opportunity of carefully examining the great mosque; and as I believe that Mr. Alexander Broadley is the only other Englishman who has done so, I may perhaps be

* The Arab historian, Makrisi, writing at the latter part of the fourteenth century, relates that a great earthquake in 1303 laid the whole in ruins, and it had to be entirely rebuilt excepting portions of the solid outer walls.—R. H. C.

allowed to make a few remarks upon this very interesting Paper. In speaking of Kairwan it must be remembered that up to the time of the French occupation the city was entirely isolated from the Christian world, and the few travellers who went there were obliged to obtain the special permission of the Bey of Tunis, and to be protected by a military escort. The great mosque was described with wonderful correctness by Mr. Rae, but he was not allowed to enter it, and was compelled to content himself with looking through the doorways. Even the Jewish traders, who came from Tunis and Susa, had to stop about two miles from the city, and there they were met by the inhabitants, who went out to buy their wares. As regards the historical interest attaching to the mosque of Kairwan, I think that Mr. Carpenter has proved conclusively that the type was followed both in Egypt and Spain; while there is another point of interest which arises from the fact that it was originally intended for a mosque, and is not, as is the case in so many other places, a church which has been rebuilt or altered to suit the requirements of the Mussulmans. I once had the good fortune to be present at a grand service in the mosque of St. Sophia at Constantinople during the fast of *Ramazan.* The building was brilliantly illuminated, and the worshippers arranged themselves in lines on the carpeted floor, with about three yards between each line. I looked down upon them from one of the galleries, and the scene was indeed a most striking one, but the general effect was completely spoiled by the fact that the lines of worshippers, as well as the carpets on which they stood, appeared crooked, as their faces were turned towards the niche of the Mihrab, and not towards the ancient altar, above which may still be traced the remains of Christian mosaics. The mosque of Kairwan was built for the purpose for which it is still used, and though it has undergone many changes, the original plan has been preserved. The interior was at first rather disappointing, as there is a want of height and grandeur, but when the seventeen beautifully carved doors, which lead into it from the great court, were opened, and the sunshine streamed in upon the forest of many-coloured marble columns, the effect was indeed marvellous, and far exceeded our expectations. The capitals of the columns inside the mosque are for the most part corinthian or composite, very few being byzantine; we noticed one in the court, which must have come from a byzantine church; on one side of it was carved a cross, on another a vine leaf, and on a third the round globe of the world. There can be no doubt that the Roman cities in the neighbourhood of Kairwan furnished most of the columns which are now in the mosque. The city is only twenty-seven miles from Susa, where the remains of the old town of Hadrumetum can be easily traced, and at no great distance is El-Jem, the ancient Thysdeus, where there is a magnificent Roman amphitheatre, the walls of which are a perfect treasure-house of early Arabic inscriptions. The French Archæological mission has lately been making excavations near the amphitheatre; in one place a pavement of large slabs has been discovered, and in another we picked up fifteen pieces of marble of different kinds, which appeared to be fragments of the columns of a temple. I mention these details in order to show that the founders of the mosques of Kairwan would have no difficulty in obtaining as many marble columns as they wanted, and also to call attention to the fact that there are Roman remains of great interest in that part of Tunisia. I may add, that owing to its proximity to the sites of Carthage and Utica, and also to that of Uthina, now called Ondena, where the ruins of the ancient city cover an area of several miles, the town of Tunis affords good head-quarters for architects as well as for

archæologists, and if any should happen to go there, I would strongly recommend them to follow our example and to visit Kairwan, where the mosque alone will amply compensate them for any difficulties and discomforts which may be met with on the journey.

FRANCIS PERCIVAL.

[Notes on Cordova Cathedral communicated by Wyatt Papworth, *Fellow.*]

Cordova cathedral is dedicated to the Assumption of the Virgin and S. Raphael. There are views and details of it in M. Girault de Prangey's *Architecture des Arabes*, fo. and 8vo., Paris, 1839-41; in the *Antiguedades Arabes*, published by the Royal Academy, fo., Madrid, 1780; Laborde, *Voyages Pittoresques*, fo., Paris, 1807; Murphy, *Arabian Antiquities*, fo., London, 1813; also Gailhabaud, *Monuments, &c.*, 4to., Paris, 1850, vol. III.; Ville Amil et Escosura, *España Artistica*, fo., Paris, 1842, vol. I., pl. 40. The best plan is given in the *Monumentos Arquitectónicos de España*, published by the Spanish Government, fo., Madrid, 1859, and in progress, pl. 77.

The first portion, eleven aisles wide, commenced (786) for (Abde-r-Rahman) Abd-el-rahman I., and continued by his son and successor Hixem (or El Hakeem) I. (788-96). This portion was cleaned and restored 1816, under the direction of the architect, Patricio Funiel.

One of the Hakeems, probably the first (796-822), added the court or atrium called the "patio de los Naranjos," said to have been rebuilt 937 or later. Beneath it was found (1767) a tank 40 feet square, in nine bays, with 6½ feet between the soffit of the vaults and the pavement of the court. The fountain in the *patio* was designed (957-8) according to an inscription upon it, by the architect Said ben Ayoub, who worked there 961-8. Llaguno y Amirola, *Noticias de los Arquitectos*, 4to., Madrid, 1829, i. 241; and Conde, *Dominion of the Arabs*, 8vo., London, 1854, i. 448.

Alhakem II. (961-67 or 70), extended the edifice for the eleven aisles southward; erected the seven-sided *Mihrab* or holy niche, 15 feet in diameter, covered by a monolithic roof, now called the capilla di S. Pedro or del Zancarron, (J. B. Waring, in *Builder*, X., 39); and the *Maksoorah;* both described at great length by M. Girault de Prangey, p. 43-50, with illustrations.

Repairs were made (981-8) by the Hagib Muhamad Almanzour (981-1000), under the superintendence of Abdallah ben Said ben Muhamad ben Batri, who was Sahib Xarta of the city (Conde, i. 507), and the patio continued; these were probably the eight eastern aisles erected in thirty months, each about 325 feet long and 20 feet wide.

The gutters between the roofs are of lead as thick as a finger, and wide enough for two persons, and supported on walls 4 feet 6 inches thick, standing on arches on the columns (Waring, in *Builder*, X., 39).

The city was regained by the Christians, 1263. The *mimbar* or *maksoorah* was converted into the sacristy, 1257-74. Charles V. gave permission for the pillars to be destroyed when, in 1523, "la gran obra del crucero" was commenced in the Plateresque style by the architect, Hernan Ruiz I., who was succeeded (1547) as *maestro mayor*, by his son Hernan Ruiz II. (died 1583), who completed (1571) the *capilla mayor;* and was succeeded (1582) by Juan de Maeda or his son Asensio. The church was finished (it is presumed on the advice of Diego de Praves, *maestro mayor* of Valladolid, who was consulted 1597), by Asensio de Maeda, 1593-9; and he was succeeded by Juan de Ochoa (1601-6) as director of the works of the interior.

The *custodia* or tabernacle is a fine work by Enrique de Arfe, 1513-8, repaired 1753 and 1784. The *silleria* or stall work, of mahogany, was begun (1748) by Pedro Duque Corneja, who died 1758 (aged 80), in the year it was finished.

The *retablo mayor*, of jasper and bronze, designed (1614) by the Jesuit Alonso Matias, was carried-out by him from 1618, but being superseded (1626), J. Aranda de Salazar completed it, 27 April, 1628. The tabernacle, from the designs of Matias, was completed (1653) by Sebastian Vidal. The capilla real was commenced 1607. The sacristy, or capilla del Cardinal Salazar (who died 1706), was the work (1700) of Don Francisco Hurtado Izquierdo, *maestro mayor* of Madrid, who is said to have been the inventor of a style, like his contemporary Churriguerra.

Murphy saw the original wooden roof above the plaster-work of the modern arches or light vaulting in brickwork, sometimes called the cupolas, introduced (1713-23) by Valle Ledesma.

About 75 feet of the tower, called *saumah* according to M. Girault de Prangey, p. 28, of the mosque (standing on the west side of the gateway of the *patio*), taken down and rebuilt in thirteen months for Abd-el-rahman III. (El-nasr-Ledin-Illah), was retained by Hernan Ruiz I., who added about 90 feet to it. It

was still incomplete when it was so much damaged (1589) by a hurricane, that Hernan Ruiz III. made fresh designs (1593-1604). The sixth storey was finished (1664) by Juan Francisco Hidalgo, as *maestro mayor.* The repairs necessitated (1755) by an earthquake, were finished (1763) by Luis de Aguilar ; it is now 240 feet high and 30 feet square.

WYATT PAPWORTH.

References to the Plan of Cordova Cathedral.*

1. Puerta del Perdon. (Gate of Indulgences.)
2. Puerta de las Bendiciones.
3. Puerta de Sta. Catalina.
4. Puerta del Cristo de las Penas. (Chapel of our Lord of Sorrows.)
5. Postigo del Obispo. (The Bishop's door.)
6. Postigos. (Doors.)
7. Capillas. (Chapels.)
8. Altares. (Altars.)
9. Oficinas. (Workshops.)
10. Carpinteria. (Carpenter's shop.)
11. Galerias ó paseo. (Galleries or passages.)
12. Capilla de Sn. Eulogio.
13. Capilla de Sn. Esteban. (Chapel of St. Stephen.)
14. Capilla del Mayor Dolor. (Chapel of the Agony.)

15.}
16.} Capilla de Ntra. Sra. de la Rosa. (Chapel of our Lady of the Rose.)

17. Capilla de Sn. Miguel.
18. Capilla de los Reyes. (Chapel of the Kings.)
19. Capilla del Rosario. (Chapel of the Rosary.)
20. Capilla de Sn. Garcilaso.
21. Capilla de los Stos. Mártires. (Chapel of the Holy Martyrs.)
22. Capilla de Sta. Ursula.
23. Capilla de St. Antonio.
24. Capilla de Sta. Ana.
25. Capilla de la Antigua.
26. Capilla de Sn. Juan Bautista.
27. Capilla Bautismal. (Baptistery.)
28. Capilla de Sn. Nicolas.
29. Capilla de la Especctacion.
30. Capilla de los Obispos. (Chapel of the Bishops.)
31. Capilla de la Conception.
32. Capilla de Sn. José.
33. Sacristia. (Sacristy.)
34. Capillas que sirven de Atarazana. (Chapels now used as storerooms.)
35. Sacristia del Sagrario. (Sacristy.)
36. Capilla ó Iglesia parroquial del Sagrario. (Chapel or Parish Church of the Pyx.)
37. Sacristia.
38. Sala Capitular hoy dia Atarazana. Capilla del Guadalcazar. (Chapter House—now a storeroom.)
39. Sala. (Chamber.)
40. Capilla de Sn. Antonino.
41. Capilla de Sta. Ines.
42. Capilla del Cardenal.
43. Sacristia.
44. Tesoro. (Treasury.)
45. Capilla de le Cena. Parte oriental de la Maksurah. (Chapel of the Last Supper—originally the eastern part of the Maksoorah.)
46. Vestibulo del Mihrab. (Vestibule of the Mihrab.)
47. Mihrab.
48. Parte occidental de la Maksurah. (Formerly the western part of the Maksoorah.)
49. Oficinas de la Catedral y Cabildo. (Workshops of the Cathedral and Chapter.)
50. Archivo. (Archives.)
51. Atarazana y muebles. (Storeroom.)
52. Capilla de Almodovar.
53. Atarazana. (Storeroom.)
54. Escusados. (Treasury of the Escusados—the Pope "excused" payment of the tenth part of the tithes, and granted it to the King as a subsidy.)
55. Capilla de Sn. Pedro.
56. Capilla de Sn. Acasio.
57. Capilla de la Trinidad.
58. Capilla de Sn. Antonino Abad.
59. Capilla de la Concepcion.
60. Capilla de Sn. Simon y Judas.
61. Capilla de Na. Sa. de Nieves.
62. Capilla de Sn. Agustin.
63. Capilla de Sn. Ambrosio.
64. Capilla de Sn. Pablo.
65. Sacristia de la Capilla de Villaviciosa *y Capilla del Rey Don Fernando.*†
66. Capilla de Villaviciosa. (*Here was placed the seat of the Kaliph during prayer*).
67. Escaleras del Organo. (Stairs to the organ.)
68. Narthex de la Prima. Catedral. Antiqua Cámera de la Limosna. (Narthex of the first Cathedral formed within the Mosque—now the place where alms are distributed.)
69. Roman miliary columns.
70. Ancient ablution tanks.

R. H. C.

* The plan given in Illustn. l. fig. 127, and the references to it (except the notes in English) are taken from the government work now in progress, entitled *Monumentos Arquitectónicos de España.*—R. H. C.

† I have ventured to correct the government work as described in Nos. 65 and 66. The italics are mine. —R. H. C.

VIII. THE MOSQUE-CATHEDRALS OF CORDOVA AND SEVILLE AND SOME ARABIC BUILDINGS. (xlvii)

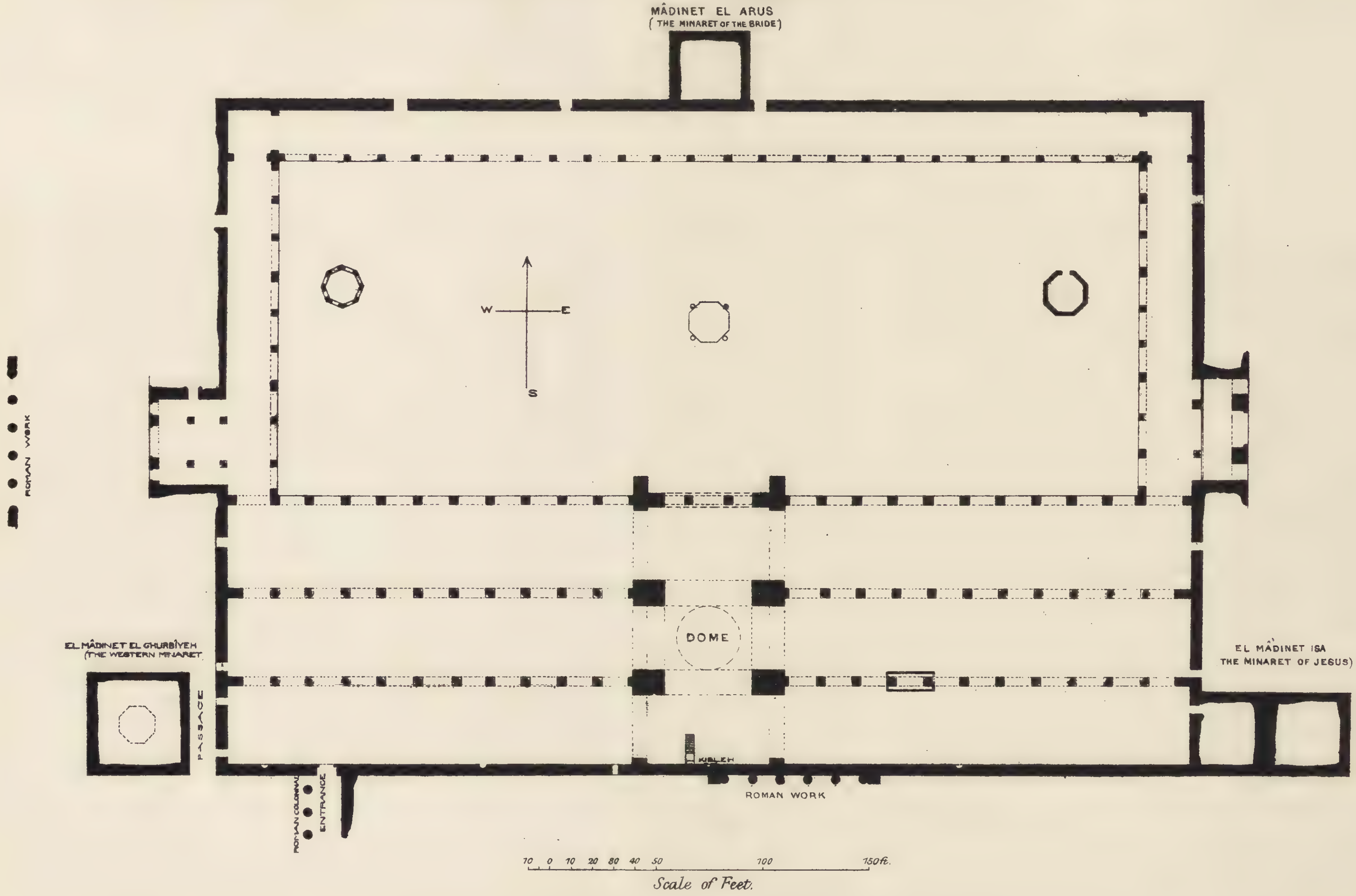


FIG. 124. PLAN OF THE GREAT MOSQUE AT DAMASCUS.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

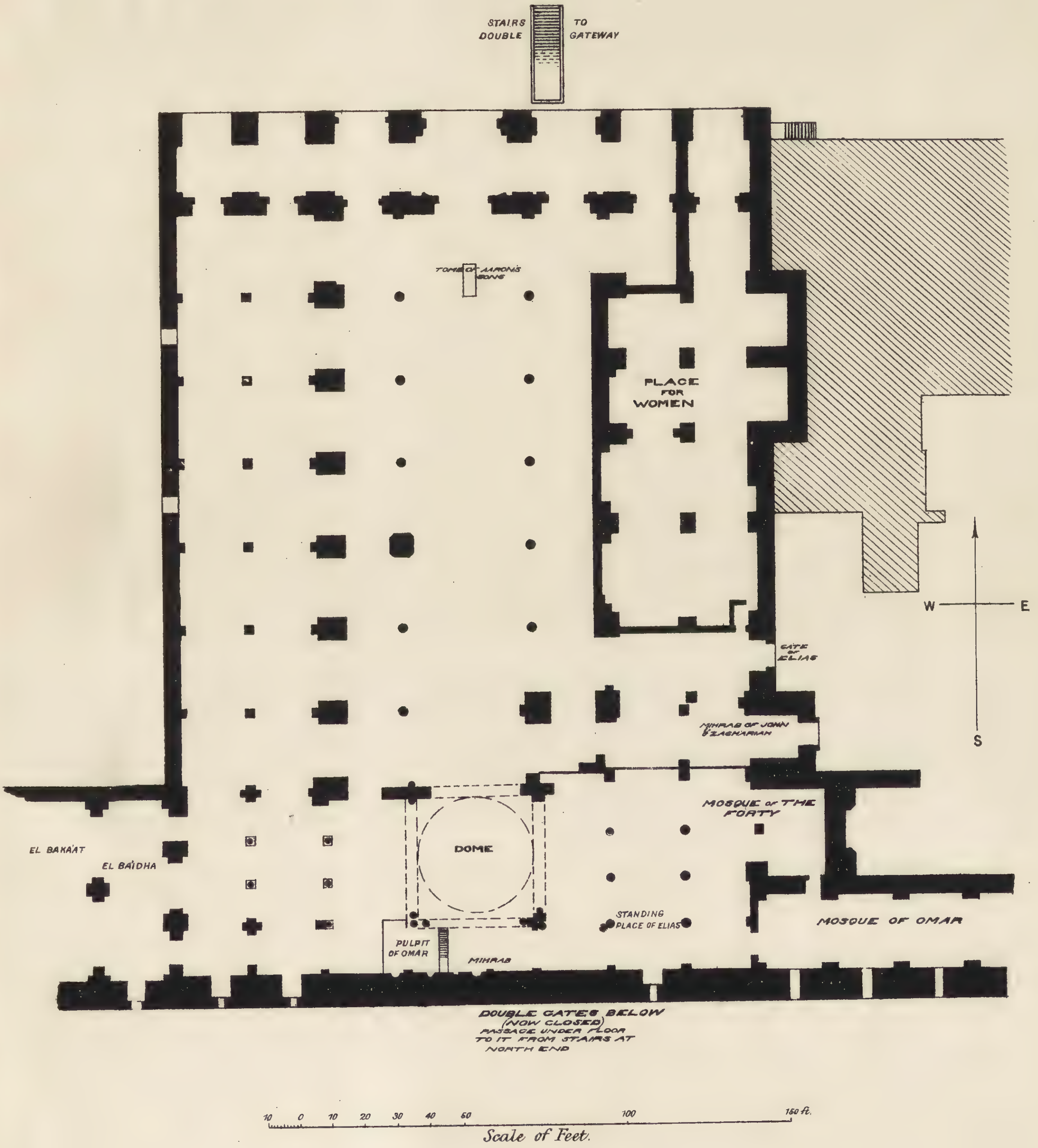


FIG. 125. PLAN OF THE AKSA AT JERUSALEM.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

VIII. THE MOSQUE-CATHEDRALS OF CORDOVA AND SEVILLE AND SOME ARABIC BUILDINGS (xlix)

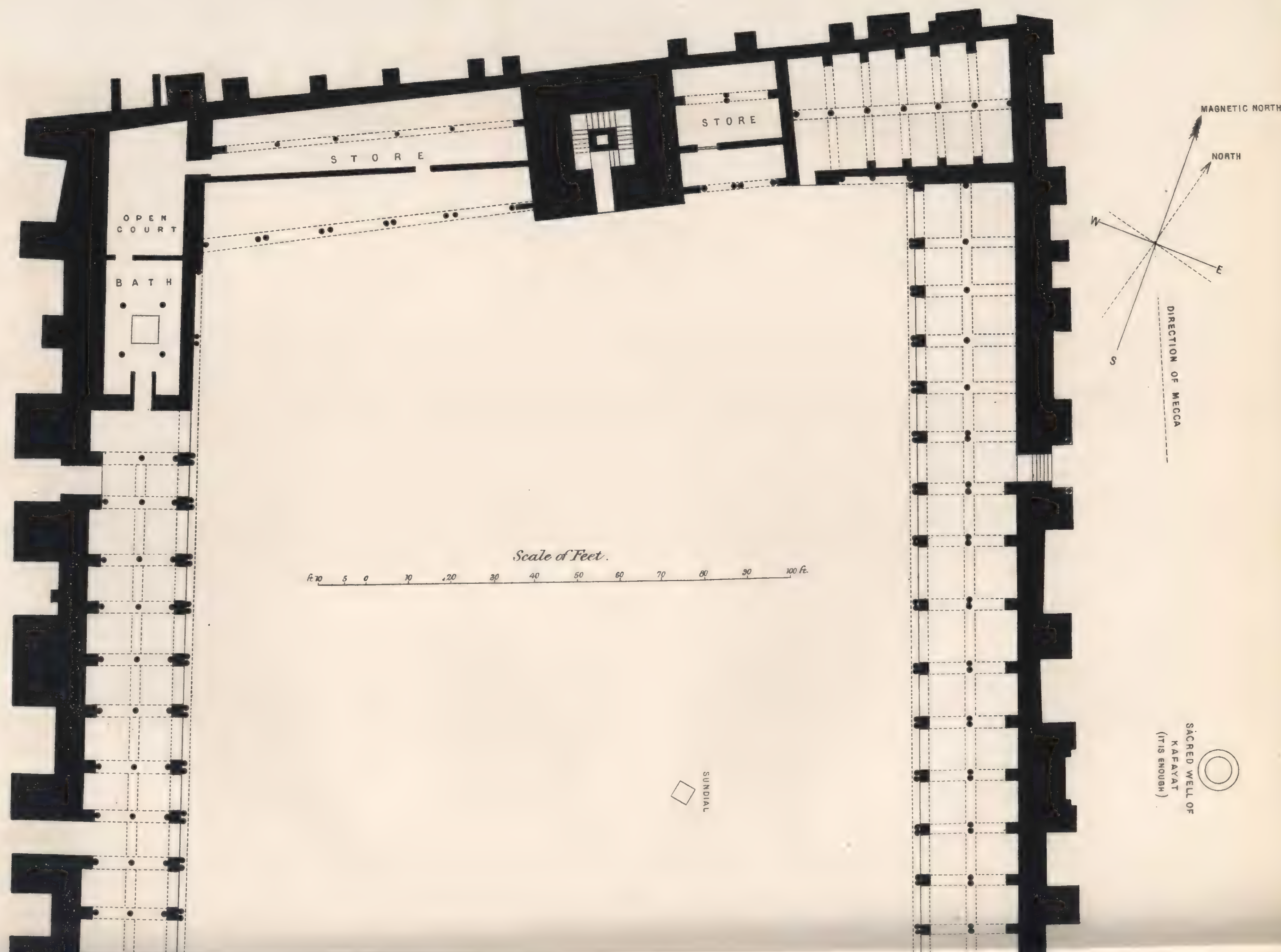
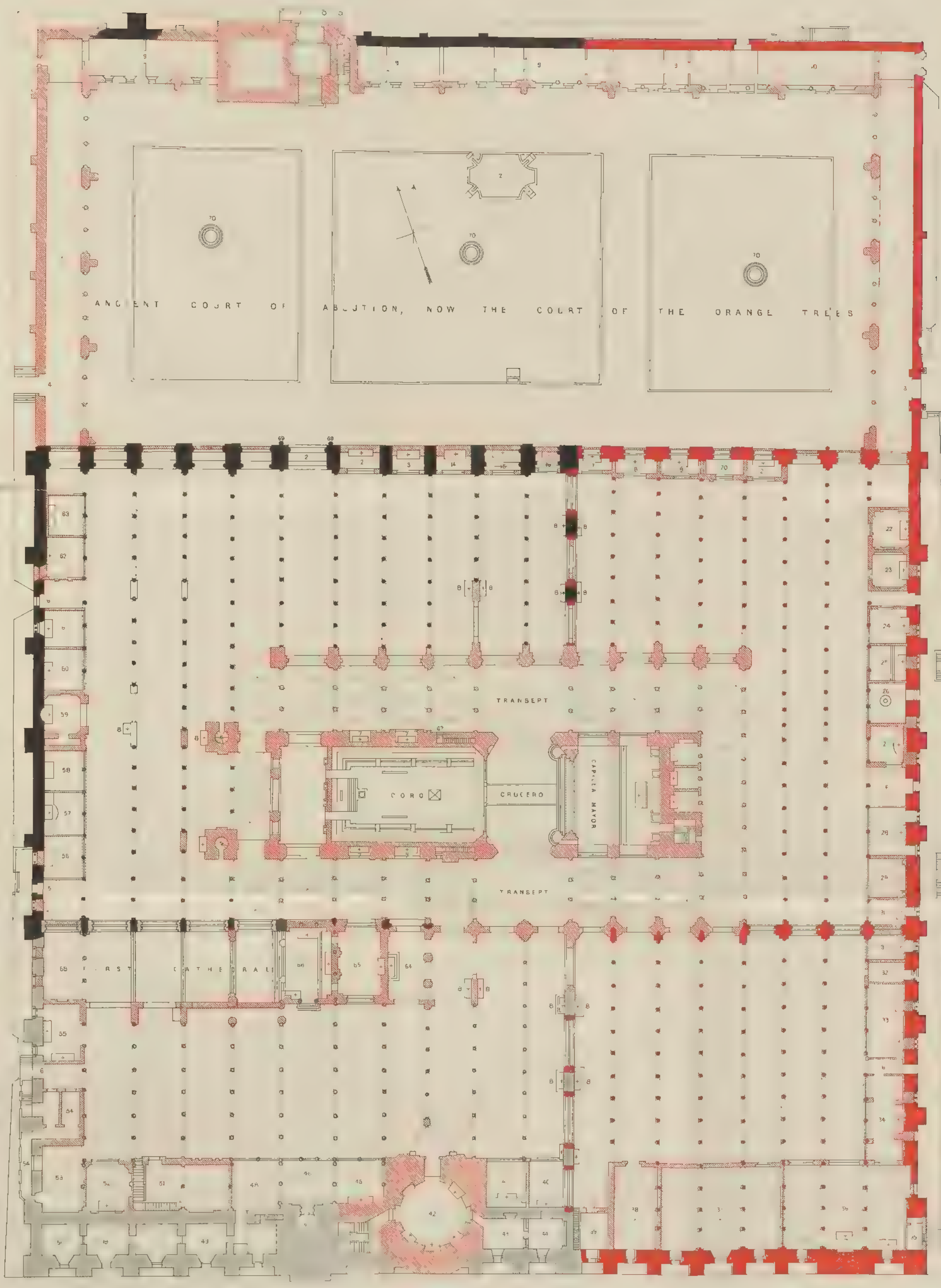


FIG. 126, PLAN OF THE GREAT MOSQUE AT KAIRWAN.

C. F. Kell. Lith. 8, Castle St. Holborn. London. E.C.



NOTE
There is no indication on the Spanish Government plan of the various dates of the buildings
R.P.C.

Scale of Feet

Scale of Metres

Denotes Abd el Rahman's work
El Hakem's work
El Mansur's work
The Christian work from 13th to 17th century
Modern work

FIG. 27 PLAN OF THE CATHEDRAL OF CORDOVA

FROM THE MONUMENTOS ARQUITECTONICOS DE ESPAÑA

Back of
Foldout
Not Imaged

IX. NOTES ON DOMESTIC BUILDINGS IN SOUTHERN SWEDEN.

By Mr. Alexander Beazeley, M.Inst.C.E.

[Read on Monday, 23rd April 1883, David Brandon, F.S.A., *Vice-President*, in the Chair.]

When honoured with an invitation to read a Paper before the Institute of Architects, I felt at a loss to think of a suitable subject upon which, with my limited knowledge of architecture, I could hope to say anything worthy its attention. As, however, I had resided several years in Sweden, it occurred to me that a few memoranda on the domestic buildings of that country—a subject not hitherto brought before the Institute—might possess some interest. I do not attempt to treat the matter exhaustively, but rather to notice a few leading features, and to give a general sketch that may induce others to pursue the investigation further.

Few persons can travel in the southern provinces, especially in remote country districts, without seeing some cottage or farmhouse whose middle part, long and low, is flanked at each end by a block of considerable relative height. Built of logs or slabs, its thatched or turf-covered roof occasionally affording pasture to goats or sheep, it presents a singular and striking appearance not readily forgotten. Research into the genesis of this strange building carries us back to those remote times when the Gothic immigrant, exchanging a wandering life for settlement and agriculture, sought-out a fixed abode, and became a "yeoman" or dweller in villages, a "bonde" or tiller of the soil.

The dwelling-house of the ancient homestead [Illustn. li, figs. 128-130], was a low detached building of oblong quadrilateral form, whose end walls faced north and south. It was constructed of logs, laid one upon the other and rudely notched together at the corners, without dowels or other connection between the intermediate parts of the several courses. The roof, consisting of poles resting against a ridge secured to the summit of the gables, was sheeted with birch-bark and covered with turf. The entrance to the house was always at the end facing south: the door was low, made of planks fastened together by cross-pieces, and hung upon wooden hooks of natural growth. The roof projected over this end, forming an open verandah, with a tie-beam supported by two posts. The interior of the house was as simple as its exterior. The fire burned in a hole or ashpit, surrounded with stones, in the middle of the earthen floor. The smoke escaped through an opening in the roof serving also to admit daylight, and found an exit besides through the door and through loopholes in the walls and gables. Above the fireplace was a slab of granite, on which bread was baked. This was the oven, and ancient legends relate that in the olden days people used to take a bath there: meaning a vapour-bath obtained by throwing water upon the heated stones. This type of house, unaltered in its principal features, still survives, although in southern Sweden no longer used as a dwelling but for other purposes, as smoking meat, malting barley, and drying flax. But even down to the time of the last generation the use to which it was chiefly put was that of providing a vapour-bath; and it is known in almost every homestead as the "bad-stofva" or bath-house [Illustn. li, figs. 128-130].

In the course of centuries the ancient gothic dwelling developed into the mediæval type of

building still existing under the name of "lag-stofva" or low-house [Illustn. li, figs. 131, 132]. Its exterior was in a general way the same as that of the earlier one, but the gables were placed east and west. The verandah at the end, no longer open but inclosed with walls, formed a covered forecourt, whose entrance was by a very low but strong door on the south side. The outer walls were constructed of logs of oak or fir, barked but not dressed. The sleepers of the gable-walls being laid, the sills of the side-walls were notched on to them, and, being thus somewhat raised above the ground, were supported on a row of boulders, as were likewise the beams serving as floor-joists. Upon the sleepers the walls were then built-up with courses of logs notched into one another at the corners, and the joints between the courses were caulked with moss. The practice of pinning the courses together with toggles or treenails is of later date, as is also the rough-hewing of their beds. The side walls were not more than 5 or 6 feet in height, whence the name "låg-stofva." As a protection against cold and draught, the stones supporting the sills were covered outside with a long bank of turf, forming a grassy seat, in fine weather a favourite resort of the elders of the household. Although the walls were low, the roof was of considerable height. The ridge rested on the apex of the gables, and was supported along its length by rafters whose feet were secured to the top of the walls; these rafters were overlaid with split poles serving as laths. In buildings of small size, instead of rafters two or more purlins were sometimes used, their ends resting on the slopes of the gables, and upon them were laid laths or poles reaching from the walls to the ridge. The frame thus in one or other manner provided was covered with sheets of birch-bark, overlaid with turf, and the gables were finished with barge-boards.

Coming to the interior, we find a great change from the primitive fireplace to a huge mass of masonry, occupying a large square space, usually in the north-east corner. In the front part was the old ashpit, almost unaltered save that the bottom was now formed of a stone slab. When beggars sought shelter in a house they always seated themselves in the ashpit, a primitive custom in many widely-distant lands. Within the fireplace, and elevated above the hearth, was the oven, now arched over, its ample top forming a drying-floor for corn and a sleeping-place assigned to mendicants who sought a night's lodging. Beyond the ashpit stood a large stove, projecting into the place originally occupied by the former, nearly in the middle of the house. It was built of granite set in kneaded clay, plastered externally with clay, and whitened. Its fireplace was wide and vaulted; and its hearth, raised about a foot above the floor, consisted of a stone slab. Above the dome of the stove, the chimney, passing through the ancient smoke-vent near the ridge, rose high above the roof. To strengthen it, and to shoot-off rain, the shaft was sometimes inclosed with boards set on end and bound together with withes. The top of the flue had a damper, consisting of a board or a flat stone fastened to the end of a long pole, working on a fulcrum formed by a forked stick fixed to the ridge, its longer arm extending down over the slope of the roof so that it could be reached from the ground and the damper operated from outside.

On the southern slope of the roof was a quadrangular aperture serving as a window. It could be closed by a trap-door; but from an early period it was also furnished with a frame covered with the midriff of a slaughtered beast or with plaited slips of very thin wood, the latter known to have been actually in use during the last generation. In the sixteenth century these primitive contrivances began to be supplanted by a sash with small panes of

coarse glass set in lead. But down to a comparatively recent period the only openings elsewhere were loopholes, secured by shutters; and it is not until the early part of the seventeenth century that mention is made of glazed windows in the walls of a few houses belonging to the better classes, some appearing to have had two or even three windows.

The internal arrangement of the "låg-stofva" was such that the building, although merely one room, fell naturally into three portions, determined chiefly by the position of two tie-beams, stout poles secured to the rafters at about 7 feet above the floor, extending right across the house. The space between the eastern gable and the stove, nearly half being occupied by the oven already described, had an earthen floor, and was devoted to ordinary household work. Here bread was baked, ale brewed, victuals cooked, and spinning and other domestic industries carried-on. The middle section, extending from the stove to the second tie-beam, was nearly square in plan. This was the household living-room, and had a floor of slabs or planks. A broad and stout timber bench ran along the northern and southern walls, and served the inmates as a seat by day and a couch by night. The third portion, between the second tie-beam and the western gable, was the state-apartment. It contained the "hög-bord" or high-table, a long and massive piece of furniture, used on festive occasions as a dining-table, and serving as a sleeping-place for distinguished guests. Along its western side ran a bench, fixed to the wall. Along its opposite side was a removable one, forming the line of demarcation between the living-room and the state-apartment. At the southern end was a short settle with a high back, behind which was a narrow space leading to a little postern or wicket in the western wall. At the upper or north end of the table stood an ornamented bench, raised somewhat above the level of the others, and having a gaily painted wooden canopy supported by two tall posts. The posts were carved with various devices, often of highly decorated design. This bench was the "hög-säte," high-seat or daïs, the chief place of the whole house. It served the double purpose of seat and bed, and in both respects was exclusively reserved for the use of the master and mistress. A distinguished guest was, however, always invited to take a seat there, and instances are recorded of visitors having been so highly honoured that the goodman and goodwife gave it up to them as a bedplace. It was, above all other parts of the house, a place of reverence and a sanctuary against violence. Moreover, its construction and position rendered it a coign of vantage, and even so late as the beginning of the seventeenth century it was the yeoman's armoury. When, therefore, at some revel a breach of the peace threatened, the host desiring to take any one under his special protection bade him come up thither. And when, as often happened in those rude times, strife broke out and blows were dealt, the person assailed sought sanctuary in the daïs. It was there also that the yeoman, attacked in his own home, made a final stand in the hour of extremity.

Besides the main dwelling, the ancient hamlet or homestead consisted of a number of other buildings, large and small, devoted to various purposes and forming usually the enceinte of an irregular quadrangle. In the midst rose a tall structure, corresponding to the keep of mediæval strongholds. This building was the "loft" or blockhouse. The lower storey, built of logs, and used as a storehouse, had no external door. Upon its walls were framed great beams, whereon was erected an upper storey projecting at one side over the wall below. The means of ingress was by a steep ladder, removable and capable of being drawn-up, resting against one of the projecting beams; and thus the entrance was on the upper floor. The projecting

portion was divided longitudinally into two parts: the outer one a covered balcony, approached by the ladder; the inner one an entry-gallery, lighted by a long horizontal aperture under the roof. From the gallery opened the doors giving access to the interior, which contained two or more rooms, lighted by loopholes in the walls, and serving as guest-chambers and bedrooms. When a bishop visited a country parsonage, he was generally lodged in the blockhouse, whence that building is sometimes mentioned as "the bishop's loft." Here also, in the larger sort of homesteads, was the apartment of the daughters of the house, who on warm summer days loved to exchange the closeness and heat of the interior for the coolness of the gallery, where they would sit and ply their busy needles. Some blockhouses had a garret in the roof, a favourite depository for valuables and cash, which even there were not always secure against mediæval burglars; and many cases are recorded of successful roof-breaking, the only means whereby felonious entrance could be effected.

The style of the buildings above described, specimens of which are still extant, belongs to the early part of the middle ages. Romances of the thirteenth and fourteenth centuries contain accounts of cotemporary aristocratic mansions exactly resembling the yeoman's homestead of the seventeenth and eighteenth centuries and even of our own time. Although rural domestic architecture thus on the whole retained its ancient character, it could not fail to be in many ways affected and modified by the altered circumstances and requirements of a later period. One of the most material of these changes began towards the close of the middle ages, when the blockhouse was shifted from its original place in the midst of the homestead to the eastern end of the dwelling-house [Illustn. li, fig. 133], and erected over the covered forecourt as a protection to the external door, for whose defence the projecting gallery afforded great advantages. The doorway itself was so low that no one could enter save in a stooping posture. It was not until a much later period that it was made of its now usual height. But even then the possibility of having to stand on the defensive was not overlooked, and the door was made in two halves, of which only the lower was opened when unexpected visitors were to be admitted after nightfall. The next material innovation was the conversion of this forecourt-blockhouse into a building having neither a projecting upper storey nor an entry-gallery, the stair or ladder being shifted to the interior of the forecourt. It then began to be the practice, in larger homesteads, to erect a similar building at the western end [fig. 134]. The entrance to this was through the postern already mentioned, into a room without fireplace, used generally as a store-room, and lighted by loopholes instead of windows. An internal stair led to the floor above, containing two or more rooms used for various domestic purposes. At a later period windows were substituted for loopholes, and an external doorway was opened.

The interior of the "låg-stofva," which down to the beginning of the seventeenth century retained its thoroughly mediæval arrangement, underwent by degrees various alterations. Thus we find, in 1749, that the pillars supporting the canopy of the daïs were being replaced by two small cupboards standing upon the high-seat itself; and these, developed in their turn into moveable pieces of furniture, long retained evidence of their original position having been upon a rectangular support or bench. The benches along the walls were converted into regular sleeping-bunks; and the divisions between the several parts of the house were marked by partitions. The oven and its appendages, which formerly as a rule occupied the north-east corner of the living-room, came to be built in the south-eastern corner or elsewhere. The

principal window retained its southern aspect, but was enlarged and placed vertically on the wall, forming a dormer, the top of which, like the horizontal beams of the roof, was boarded-over and covered with a thick layer of clay to keep-in warmth.*

From an early date it appears to have been the custom to thatch outbuildings with straw; but it was only by degrees, and at a comparatively recent period, that thatch was employed for the roof of the dwelling. Even at the present day it is by no means universal; and in the use of turf-clad bark survives perhaps the faint reminiscence of a time when the yeoman's house was literally his castle, and when the lives of himself and his family might come to depend upon its capability of withstanding an attack by fire.

Nor was change confined to external form and internal arrangement. Owing probably to gradual clearance of the primæval forest, and increasing difficulty in obtaining timber of large girth, necessitating economy of material, the construction of the walls began to undergo modification. Upon the ground-sills posts were erected at each corner and at the junction of cross-walls. These posts were grooved vertically to receive the ends of the horizontal timbers forming the walls, consisting of slabs or of split logs rudely squared, their ends thinned-down to fit into the grooves. I am not aware whether there is direct evidence to show, but the supposition is a probable one, that the practice of trimming the upper side of each course to a convex shape in cross-section and the under side to a concave [Illustn. liii, fig. 146] dates from the period when increasing scarcity of material necessitated the use of thinner timbers for the walls and greater care in forming their horizontal joints. To the same cause, and also to the difficulty of procuring single trees of sufficient length for each course, may be probably ascribed the use of treenails for securing the several courses together. Sometimes the walls were of upright slabs, an arrangement allowing the use of much shorter timber than did the older methods of construction. In this case a wall-plate was mortised on to the corner posts, its under side grooved to receive the tops of the slabs; the slabs were rebated or grooved together, and the joints caulked with clay or moss. I have dwelt at some length upon the "låg-stofva," because it affords a remarkable example of a development whose successive steps we are able, with tolerable certainty, to trace. In its primitive and some of its intermediate forms it is found, with various modifications, throughout the Scandinavian peninsula, from Ystad to Haparanda; but the long low building terminating at each end in a high block is, so far as observation and research enable me to judge, wholly peculiar to southern Sweden.

Turning now to urban habitations, it may be observed that those of the middle ages, while exhibiting features well deserving study, contrast less widely with those of other lands than do the rural dwellings. It is on coming down to recent and modern times that we are most struck by peculiarities of design and detail; and of these I proceed to give some account, premising that, although some of those peculiarities are not exclusively confined to Sweden, they nearly all differ from the English pattern and practice.

In Stockholm, Gothenburg, and other large towns, self-contained dwellings are to be met-with; and, in the suburbs, detached or semi-detached villas closely resembling our own have

* In the foregoing I have made free use of Hyltén-Cavallius's *Wärend och Wirdarne: ett försök i Svensk ethnologi*, 8vo. Stockholm, 1868. There is no exaggeration in saying that it would be worth while to learn Swedish, were it only for the enjoyment of reading this delightful book in the original.—A.B.

of late years become not uncommon. But the great majority of the inhabitants still dwell in flats; and of the plans of eight such in Halmstad, a southern provincial capital, I have prepared diagrams showing their general arrangement [Illustn. lii]. Figs. 136, 138 and 141 are ground-floor apartments; the others, figs. 135, 137, 139 and 140, are on the first floor. One was inhabited by a judge, one by a lawyer in good practice, one by the inspector of Customs, two by civil engineers, and the others by merchants and well-to-do tradesmen; and they may thus be taken as fair types of good middle-class dwellings. It will be seen that these plans, while differing from each other in the number and arrangement of the rooms, preserve a general resemblance in the absence of means of separate access to the several apartments, which are for the most part *en suite*, with wide internal doorways. This suits the habits of the people, who occupy their bedrooms as sitting-rooms, and, when they have company, throw open the entire suite to the guests. It possesses the merit of economizing space and keeping the temperature of the apartments equable throughout. An obvious objection from an English point of view is the fact that, in most cases, the dining-room and even the kitchen are approached through one or more of the bedrooms. This, however, is regarded as of little if any importance. The beds, always unobtrusive and extremely short, are rendered yet shorter and less prominent by being telescoped during the day; washing-stands and so forth are shut-up into the semblance of cabinets and chiffoniers; and the other furniture accords with the general use of the apartment as a sitting-room, so that one soon gets accustomed to it. Above the inhabited rooms is a loft in the roof, partitioned-off among the tenants of the flats, or common to all, according to circumstances. It is used as a place for storage of various articles, and for drying clothes, the household washing being as a rule finished and got-up at home. One apartment, usually provided within English houses, is not shown on any of the plans, being situate outside, in the yard. In some of the larger towns, sewerage resembling our own has been partially introduced; but in Halmstad, and most other towns, sewers are provided to carry off surface-drainage only, and no other arrangement than that alluded-to is possible save in exceptional cases. At the rear, generally of each house, but sometimes of a group of houses, is a yard, partly or wholly inclosed by buildings. The approach from the street is by a *porte-cochère*, having strong gates which are securely fastened at night. When a house stands at the junction of two streets, the building regulations of some towns, and the general custom of all, require that there shall be access to the yard from both; the practical result being that an entrance through the house as well as through the gateway is insisted-on. This was amusingly illustrated in the case of one dwelling [Illustn. lii, fig. 138]. It is on the ground floor, the upper storeys being used as a corn warehouse. The only other buildings in the yard are a stable and outhouse, the remaining boundaries being walls of contiguous houses not opening on to it. I occupied this dwelling as a residence and office, and, having an objection to the existence of a passage to the yard directly through my premises, which would have been used as a thoroughfare by the men employed about the place, I stipulated that the landlord should provide a store-room in the hall by building two party-walls across it. Before this could be done he had to apply to the authorities for permission, which, after due discussion and official inspection, was granted on condition that each wall had a door in it, hung to open rearwards, so that in the event of fire on the premises access could be had to the yard, even though the doors should be locked, by bursting them from the front or street side.

The building of timber houses is prohibited in most of the towns in the South: concrete is only beginning to come into use: and stone and brick are the materials chiefly employed. Where good building-stone is abundant, the manner of dressing and setting, practically the same as with us, does not call for special remark. But in the South scarce anything is procurable save gneiss or granite, and this, being expensive to square and dress, when used is generally unhewn. Remarkable care and ingenuity are displayed in the placing of the stones so as to fit their inequalities into one another. As, however, a wall of rough irregular-shaped stone consumes a prodigious quantity of mortar, the use of dry stonework is very general, especially where lime is scarce. This of course is not suitable for the walls of dwellings, but it is used for foundations; and those of the railway terminus at Halmstad, a large brick building three storeys high, were so laid. Throughout Sweden, in fact, unhewn gneiss or granite, roughly knocked into shape, and laid dry, is used not only for foundations but also for piers and abutments of railway and other bridges. I have put up at least a score of such, some upwards of 20 feet high. But for even greater heights dry stonework is not regarded as unsuitable. Take for example the bridges, fifteen in number, proposed for one of the southern lines. The piers and abutments of ten of these, averaging 14 feet 6 inches high, were wholly dry. Of the other five, three were 32, one 37, and one 42 feet, of which a height of 4 feet was in mortar and the remainder dry. I am not aware of any case of failure in the stonework of such bridges.

The general size of bricks is $11\frac{3}{4}$ inches by $5\frac{3}{4}$ inches by 3 inches. In Gothenburg, where perhaps foreign example has influenced the matter, the general dimensions are $9\frac{3}{4}$ inches by $4\frac{3}{4}$ inches by $2\frac{1}{2}$ inches, and in some parts of the country they are even smaller. As far as my experience goes, the better sorts are equal to our own; whilst, for the cheaper sorts, more care is bestowed than with us on the working of the clay and the burning of the bricks, the result being a better quality. I have nowhere in Sweden met with low-class bricks so bad as some of ours, although of course such may exist. Bricks are burned either in kilns or clamps, as with us. A porous brick is made by mixing the clay with sawdust, bark, or chaff, which burns away in the process of firing. These bricks require less burning than the ordinary kind; are bad conductors of heat; and, owing to their lightness, are very suitable for many kinds of interior work. Bond differs in no respect that I know of from our own; and the only brickwork requiring special notice is the stove, or "kakelugn," so called from being cased on the outside with "kakel," or tiles. These tiles are from 12 to 13 inches high, 9 to 10 inches wide, and $\frac{3}{8}$ inch thick. A flange on the inner face forms a key for attachment. They are made of fine, thoroughly-worked clay, and fired with great care. When glazed, as they mostly are, it is on the outer face only. The best are usually white, but sometimes are figured in monochrome or colours. The commoner sorts are yellow or marbled.

The stove is built of bricks set in well-puddled clay mixed with sand, the flues and their partitions being of brick on edge. The bricks and tiles are well wetted, and smeared with wet clay before being set; each tile is filled and backed with brick and clay, and all joints are made thoroughly close and tight. The foundation of the stove is usually built solid, but some have an air-space under the hearth, communicating by a hit-and-miss valve with the air in the room. The general construction of the stove is shown in Illustn. liv [figs. 147-151]. The fireplace is an elongated vertical chamber, arched over, from the top of which, in front, a flue 6 inches square branches off to each side, passes down to the level of the hearth and along to the back, and

then rises again, the two branches uniting above the arch of the fireplace just below the damper and thence passing out by a pipe into the chimney. This pipe, 6 inches diameter, is preferably made of stout sheet-iron, set and cased in brick and clay. The damper is of wrought-iron, consisting of a plate sliding in a frame, and having an arm passing through the wall of the stove and projecting outside, by means of which it can be opened and closed. The mouth of the fireplace has a double set of doors, hung to a wrought-iron frame. The inner doors are of stout sheet-iron (*g*), each having a draught-hole (*h*) closed by a valve. The outer doors are of brass. A dining-room stove has a recess in front, furnished with brass doors, and used for heating plates, &c. Bedroom stoves have a smaller recess, without doors, for airing linen or keeping a jug of water warm. Above the arch of the fireplace is an air-passage from the room direct into the flue above the damper, closed by a hit-and-miss ventilator. The stove is used as follows: The ventilator being closed, and the damper opened, a fire is kindled on the hearth, the iron doors are shut, their draught-holes opened, and a good flare is allowed to play through the flues; the draught, if too strong, is checked by means of the damper and the valves in the doors. The sectional area of the flues being together double that of the damper, the flame and heated gases traverse them at a rate much slower than that at which they escape into the chimney, and the bends in the flues make them play upon the sides and thus further facilitate the communication of heat to the brickwork. When the fuel ceases to flame, the draught-holes are closed; as soon as it is reduced to a mass of glowing embers the brass doors and the damper are shut; and a well-built stove is thus almost hermetically sealed. The heat from the interior spreading outwards, the surface-temperature continues to rise for about a quarter of an hour or twenty minutes, the stove being then of a nearly uniform temperature throughout, and continuing to give out warmth for six or seven hours or even longer. A charge of $1\frac{1}{4}$ cube foot of good beech or oak billets will maintain, during that time, at a temperature of 62° F. a room containing 2520 cube feet, imparting also through the door to an adjoining room of 1575 cube feet sufficient warmth to allow it to be used with comfort as a bedroom. This was at any rate my winter experience as regards the rooms D and B′ in fig. 138, facing due north. In the afternoon the stove was usually heated again; and sometimes once more, late in the evening.

It will be apparent that fuel in a Swedish stove is used on a different principle from that in our open grates. We rely exclusively upon the heat radiated directly from the fire into the room, and practically make no attempt to utilize the fuel in any other way; the object being to keep up a good draught, regardless of the large percentage of heat that passes into the chimney and is lost. In the Swedish stove, on the contrary, the burning fuel is as a rule never seen, the object being to expend all its effect in heating the mass of the stove itself, which thus becomes the immediate source of warmth. It has its drawback in the absence of that cheerful glow which invests an open fire with so much charm and comfort. The increasing dearness of billet-wood has led to many endeavours to find a substitute. Fat smoky coal cannot be advantageously used, the soot deposited on the interior of the flues preventing them from becoming properly heated and thus warming the mass of the stove. The quantity of soot deposited by good billet-wood is small: chimneys of dwelling-rooms are usually swept once in every two months, and the soot seldom exceeds a few handfuls. I am not aware whether anthracite coal has been tried, but probably that or coke will prove to be the fuel

best adapted for Swedish stoves should their use be introduced into this country. One of my friends informs me that for several winters past he has used ordinary east-coast English coal, of a kind that does not produce much soot [probably good ordinary "steam-coal"], and has found it give very satisfactory results: this winter his flues had not required sweeping, up to the time of his writing on 12th March, which represents a period of at least four months' fires. The use of mineral fuel, however, involves another consideration besides that of the deposition of soot. Owing to the slowness of its combustion, a draught must be maintained in the stove during a long period, since the damper cannot safely be closed until the volatile constituents are all driven off and the glow of the cinders has at least very much abated. During all this time the air passing into the chimney is carrying away some of the heat. The stove therefore cannot be employed in the same advantageous manner as when wood is used, which gives-out a great amount of heat in a short time, and whose embers rapidly become covered with a grey ash and cease to evolve deleterious gases save in very minute quantity. But, as a set-off against some loss of heat, there must be taken into account the fact that the fire is visible. Besides, as regards this country, the use of wood as fuel does not come within the scope of a practical inquiry: with us it is a question of mineral fuel or none at all. And it is almost certain that, with ordinary care, moderately smokeless mineral fuel can be used with more economical effect in a Swedish stove than in an open grate, since the flues and the mass of the former will absorb, and subsequently radiate into the apartment, the greater portion of the heat which in the latter simply escapes direct from the fireplace into the chimney.

Mention has already been made of the joints in the walls of a timber building. The ingenuity of some of these is shown in Illustn. liii, figs. 143-146, for the particulars of which I am indebted to my excellent *confrère* Herr Nils Soneson, C.E., of Halmstad. They exemplify a quoin with projecting timber-ends [fig. 143], one with flush ends [fig. 144], and the flush-ended junction of a cross-wall [fig. 145]. The work on a real building is proportionally neat and accurate, and is wrought chiefly with the axe, in the use of which tool the carpenters of southern Sweden are very expert. They cannot, however, in this respect compare with those of Dalecarlia and Norrland, than whom no more skilful masters of the axe can be found. These will trim and square a log forty feet long as true as if cut in the saw-mill, and will dress it to a face that cannot be distinguished from planed work. One of the old school requires no other tools than the axe and the auger, and despises the saw and plane as contemptible innovations fit only for those unskilled in the handling of the nobler implement.

The items of carpenters' and joiners' work in house-building wherein the Swedish practice differs most widely from our own are flooring, doors and windows. Fig. 142 shows the general arrangement of flooring for a dwelling-room with a clear span of 18 feet. The joists, 10½ inches by 7 inches, about 2 feet 6 inches apart centre to centre, rest upon plates in the walls and are trimmed to hearths and chimneys. Great care is bestowed upon the boarding, which for good work is 2 inches thick. A margin of one board or more in width is laid all round the room, parallel and scribed to the walls, and mitred at corners. The flooring-boards are each in a single piece. If they are so short, or the room so large, that too wide a margin would be required, then they are laid in two or more equal lengths, butting against a cross margin or margins laid upon the joists or on trimmers. In all cases they are wedged as tight and close as possible before nailing. They are seldom grooved and tongued, draught being

effectually prevented by the closeness of their joints and by pugging. A fillet is nailed upon the sides of the joists, just clear of the bottom, and short boards are dropped-in between the joists. Upon these is filled the pugging, for which the best material is said to be a layer of well dried clay covered with small lime or mortar rubbish. An excellent substitute is dry sawdust, filled upon brown-paper laid on the cross boards. The space between the extreme joists and the wall is pugged upon a slip of board jammed down tight. When the skirting is fixed, a fillet is nailed upon the floor all round, covering the joint, and preventing damage to the skirting when carpets are tacked down, or to the walls by furniture pushed up too close. A floor thus laid leaves nothing to be desired as regards stiffness, neatness of appearance, and warmth. For floors of large span girders and trusses are employed, resembling those in use here for similar work. If the room beneath is to have a plastered ceiling, the under side of the joists is sheeted with $\frac{7}{8}$-inch rough boarding, well split to prevent it from warping and thus cracking the plaster. These boards are faced with a layer of peeled dry reeds (*arundo phragmites*), laid their own diameter asunder and fastened with wires, 6 inches apart, running across the direction of their length, attached to clout-nails at every 4 inches. Brass wire is used for best work. The first coat is of thin stuff, thrown smartly on so as to take a good hold all round the reeds, after which the work is finished in the usual manner. There being no stuff pushed through to form a key as when laths are used, the actual weight of plaster is less. These ceilings are very sound, durable, and free from cracks.

The frames of external doors resemble our own. Those of internal doors are rebated and carried all round, showing a sill, the bottom of the rebate in which is about 1 inch above the floor. To English ideas this seems an awkward arrangement, but experience leads me to form a favourable opinion of it. It makes the door shut close all round, and diminishes in a remarkable degree draught along the floor—in fact I do not remember to have noticed any where this plan was followed. It saves carpets from being worn by the bottom of the door; and, when desirable, a thin mat can be laid down inside. One soon gets accustomed to the sill; and the advantages of the arrangement appear sufficient to compensate for the loss of whatever enjoyment may attach to the privilege of shuffling across the threshold. Doors of communication between principal apartments are double-hung, generally 4 feet wide in the clear. As both leaves are not always kept open, the one carrying the lock is made wider than the other, so as to give an opening of 2 feet 3 inches. The panels and hanging-stiles of both leaves are alike, but the locking-stile of one is 6 inches wider than that of the other. To conceal this difference when both leaves are closed, a moulded fillet is run down the wider locking-stile on both sides of the door, and a similar fillet down one edge of each leaf projects so as to form a rebate. The device makes very neat and good work. Instead of knobs the latch usually has lever handles; the reason of which may be that, in order to preserve symmetry of appearance, the handle is placed midway in the flat between the two fillets, and, this being only 5 inches wide, a person opening the door from the outside by a knob would be apt to graze his knuckles against the fillet on the fast leaf. The bolt is rarely bevelled, so that the door is latched by means of the handle. The hinge most in use may be described as a "hook-and-ride," or "pintle-and-gudgeon," the rider being an elongated inverted cup resting on the lug carrying the pin, and the pin not quite so long as the depth of the rider. This hinge has much to recommend it. It is easily and cleanly lubricated; the leaves are

readily unshipped when requisite; and, should they from any cause ride on the sill, a washer dropped over the pin sets them up again at once.

The brickwork of window-jambs is not rebated, but flush throughout, the frames being spiked to plugs or wood bricks; and the external reveal seldom exceeds $2\frac{1}{2}$ inches. Stone or projecting brick sills are rarely seen except in large towns; and, when they are used, it can be only for the sake of architectural effect, the purpose of throwing-off rain being fulfilled in an absolutely perfect manner by a broad strip of sheet-iron chased into or tacked to the frame and bent down over the brickwork. The windows of the dwelling shown in fig. 138 were thus finished, and, although the sills of the frames were set hollow, so that I could easily get my hand under them on the outside, and this hollow was not filled-up during the three winters of my tenancy, there never was the slightest indication of damp in the wall. Nor have I anywhere detected draught or leakage between the frame and brickwork, although I carefully examined many houses before writing the article on Swedish windows which appeared in *The Builder** of 13th October 1877. Drips to head and transom are narrower than those to sill, but they are in other respects similar and fulfil their purpose with like efficiency. A lining is tongued or rebated to back of sill of frame and extends the whole thickness of wall, but jambs and soffits are not usually lined. Sometimes each casement is in one large pane. Occasionally the muntin is not continued above the transom, the upper casements being replaced by a single one hung to the head of frame or to the transom. In houses built thirty or forty years ago, and in modern houses of inferior class, the windows are smaller, and the transom and upper casements are omitted. The sashes are hung on hinges resembling those of the doors, and can be easily unshipped and lifted into the room to be cleaned or repaired; when open they are secured by stays on the hanging-styles; but when they are only to be ajar, or when windy weather would strain those stays, a loose stay-bar of thick wire is used, having an eye to fit the pin of sash-fastener on the muntin and a hook to drop into the staple on the casement. Double or inner sashes are used during the cold weather; they are of 1-inch or $1\frac{1}{4}$-inch stuff, made in two halves, which fit into the rebates on inside of frame and meet on the muntin, and are bradded or screwed in place. Their value as a protection against cold is known, but, as I believe it is not generally realized how useful they are even in our climate, and how easily they can be fitted-up, I may quote

* I therein stated that the weather-tightness of the Swedish windows is remarkable, it being quite exceptional for the heaviest rain to drive in, even when a strong wind blows against them. I have heard surprize expressed at this statement, and, in a friendly way, some doubts even as to its correctness. Considering that the rebates in the frames rarely exceed $\frac{7}{16}$ inch deep, and that they have no channels or water-stops, but are quite plain, surprize is natural. I did not, however, make the statement at random, but took pains to test its accuracy by carefully examining, after storms, the windows in various houses that had been most exposed. It would be tedious to recapitulate all the evidence upon which my conclusion was based; but one instance may be given in which the conditions were unfavourable and the result the least satisfactory of those obtained. The case is that of the dwelling shown in Illustn. lii, fig. 141; it is an old building on the west side of the market square: the frames and sashes are shrunken and worn, the rebates being barely $\frac{3}{8}$ inch deep, and the fasteners not of the best sort. In the autumn of 1875, after a strong gale and heavy rain from the eastward had been blowing full upon this house for more than five hours, I examined the inside of the three front windows. One sill was perfectly dry; in the others a little water—not enough to run off on to the floor—had blown up under the bottom of the sash; and in none was there any leakage between the frame and the top or sides of sash. I feel, therefore, that I do not overstate the matter in saying that, for weather-tightness, these windows can scarcely be surpassed.—A. B.

my own experience in the matter. One of the bedrooms in a house I recently occupied at Hastings, though it was over the dining-room, was in winter so chilly as to be uninhabitable unless a fire was lighted, and barely so even then. The window was an ordinary one, 6 feet 3 inches by 4 feet, facing north. I had a couple of sashes made of $1\frac{1}{4}$-inch stuff, hinged to the jambs of the architrave, and secured by a button when closed. This cost altogether twenty-five shillings, and answered its purpose so effectually that the room was then considered one of the cosiest in the house, and no fire was afterwards required.

I have been unwillingly obliged to omit all reference to picturesque architectural effect, of which the old Swedish buildings offer many admirable examples; and I cannot more fitly conclude than by advising those who have opportunities of travelling, to pay a visit to the country and judge for themselves. To those who delight to revel in the wealth of a rich mine of artistic and antiquarian research: who desire to become acquainted with a kindly and hospitable people, and can appreciate the charm of a language excelling in musical sweetness the much-vaunted Italian whilst rivalling our own mother-tongue in racy vigour and masculine dignity—to such I would say: Spend a vacation in Sweden, and you will assuredly desire to repeat the visit.

[Remarks by Edward I'Anson, F.G.S., *Vice-President.*]

These buildings, which Mr. Beazeley has described, not only exist in Sweden, but they exist certainly to the furthest habitable region of Europe north of Sweden; in fact, they extend throughout the whole of Norway and as far as the North Cape. Totally different from any of the buildings of western and southern Europe, such as those of southern Germany and France, they have no character about them which pertains to the mediæval buildings of those countries. The roofs do not present the same steep pitch which prevails in Germany and France, notwithstanding the northern climate. There the birch-tree acquires a much greater size than it does with us, and the bark seems remarkably resistant to wet; it forms a capital covering for the roofs, and in some cases it is covered with turf. I have seen the goats climbing on the roofs and pasturing on the top of houses. The architectural decoration, wherever there is any, is not derived from western Europe; it all seems to me to have come from the east. The great rivers of Russia, in my opinion, have carried northward the civilization of the Byzantine empire, and those decorations which we call Runic, which are seen upon the Runic stones, those interlaced serpent-like decorations, I am convinced are all of Byzantine origin. They have all come from Constantinople, through Russia, to these northern countries. Not the least interesting part of the Paper was what one seldom sees—the construction of the stoves. Such stoves are found throughout the whole of Germany and France, and I have often wondered how the inside of them is composed. When I was in Norway I bought a Norwegian stove; it was made of iron, and the principle is exactly the same, namely, a series of horizontal hollow chambers, the lower chambers communicating with those above by hollow iron tubes having the appearance of short columns. The smoke takes, therefore, a zigzag direction through these numerous horizontal chambers until it escapes ultimately by the flue at the end, and in that way you exhaust all the heating power before any of the smoke goes up the chimney.

EDWARD I'ANSON.

IX. NOTES ON DOMESTIC BUILDINGS IN SOUTHERN SWEDEN (li)

EARLY PERIOD

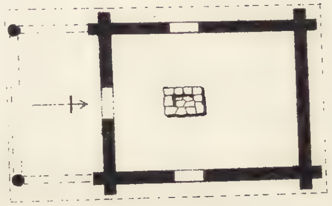


FIG. 128.

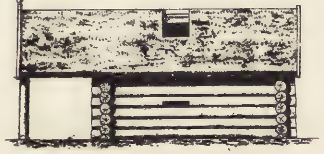


FIG. 129.

FIG. 130.

BAD-STOFVA.

(FROM HYLTÉN-CAVALLIUS)

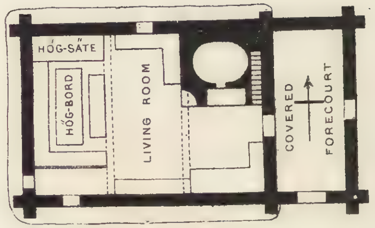


FIG. 131.

FIG. 132.

MIDDLE PERIOD

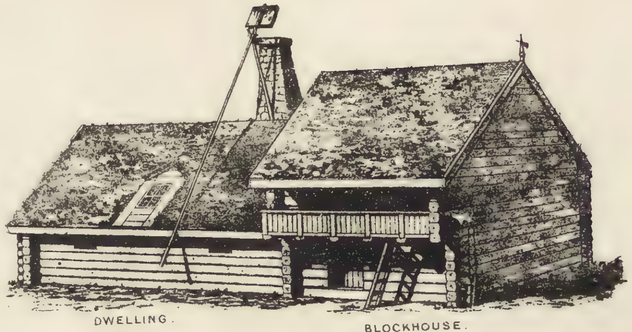


FIG. 133.

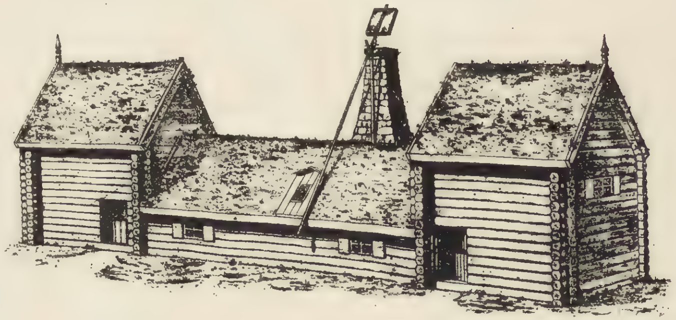


FIG. 134.

LÅG-STOFVA.

(FROM HYLTÉN-CAVALLIUS)

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

IX. NOTES ON DOMESTIC BUILDINGS IN SOUTHERN SWEDEN. (lii)

A ANTE ROOM	K KITCHEN
B BED ROOM	P PASSAGE
C CUPBOARD	S SALON
D DINING ROOM	V VESTIBULE or LOBBY

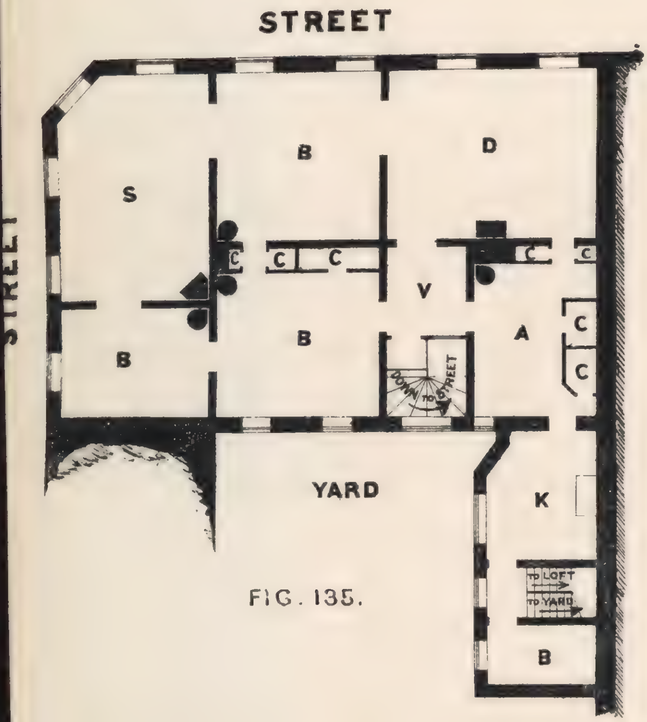


FIG. 135.

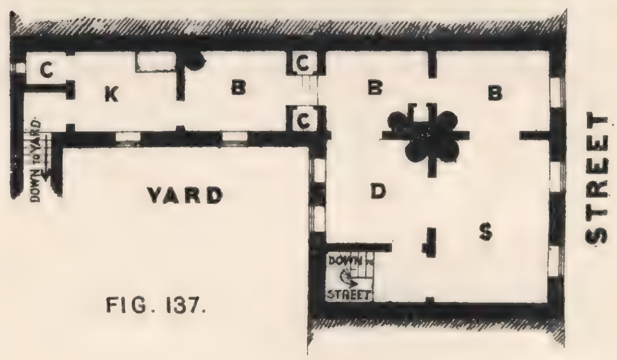


FIG. 137.

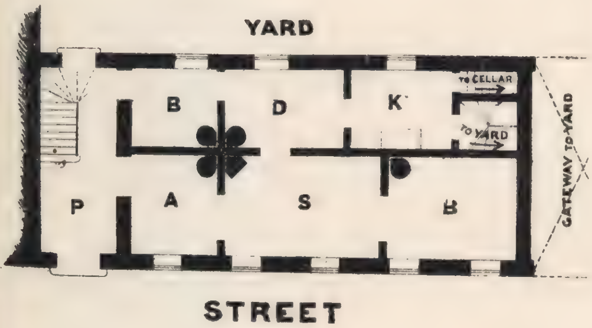


FIG. 136.

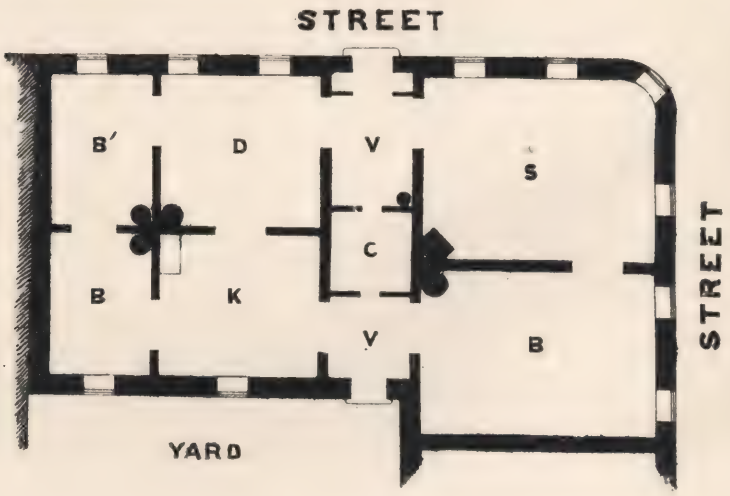


FIG. 138.

MODERN MIDDLE-CLASS

FIG. 139.

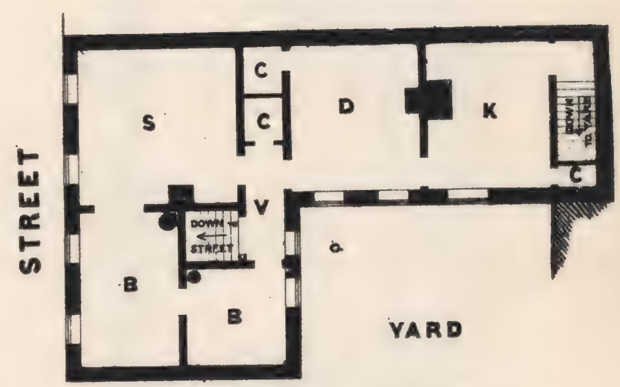


FIG. 140.

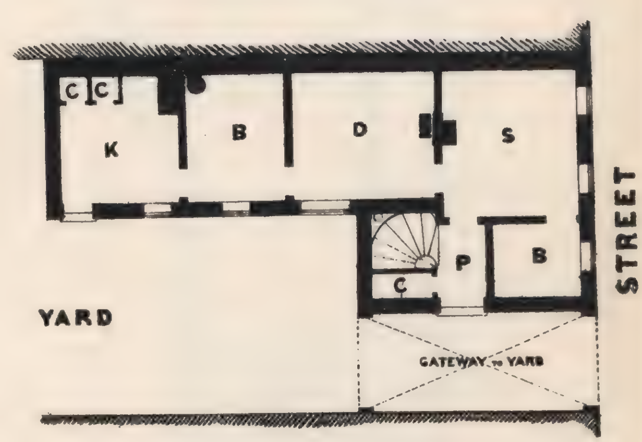


FIG. 141.

DWELLINGS IN HALMSTAD.

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IX. NOTES ON DOMESTIC BUILDINGS IN SOUTHERN SWEDEN (liii)

JOINTS IN WALLS OF TIMBER BUILDINGS

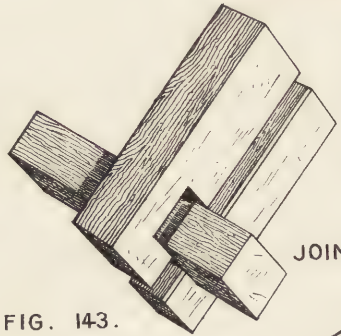


FIG. 143.
Quoin with projecting timber-ends.

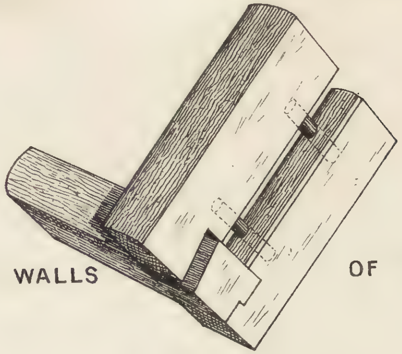


FIG. 144.
Quoin with flush timber-ends.

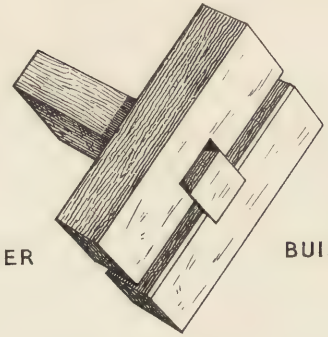


FIG. 145.
Flush-end junction of a cross-wall.

FIG. 146.
Cross section showing trimming of Bed-joints of courses.

SWEDISH FLOOR CONSTRUCTION.

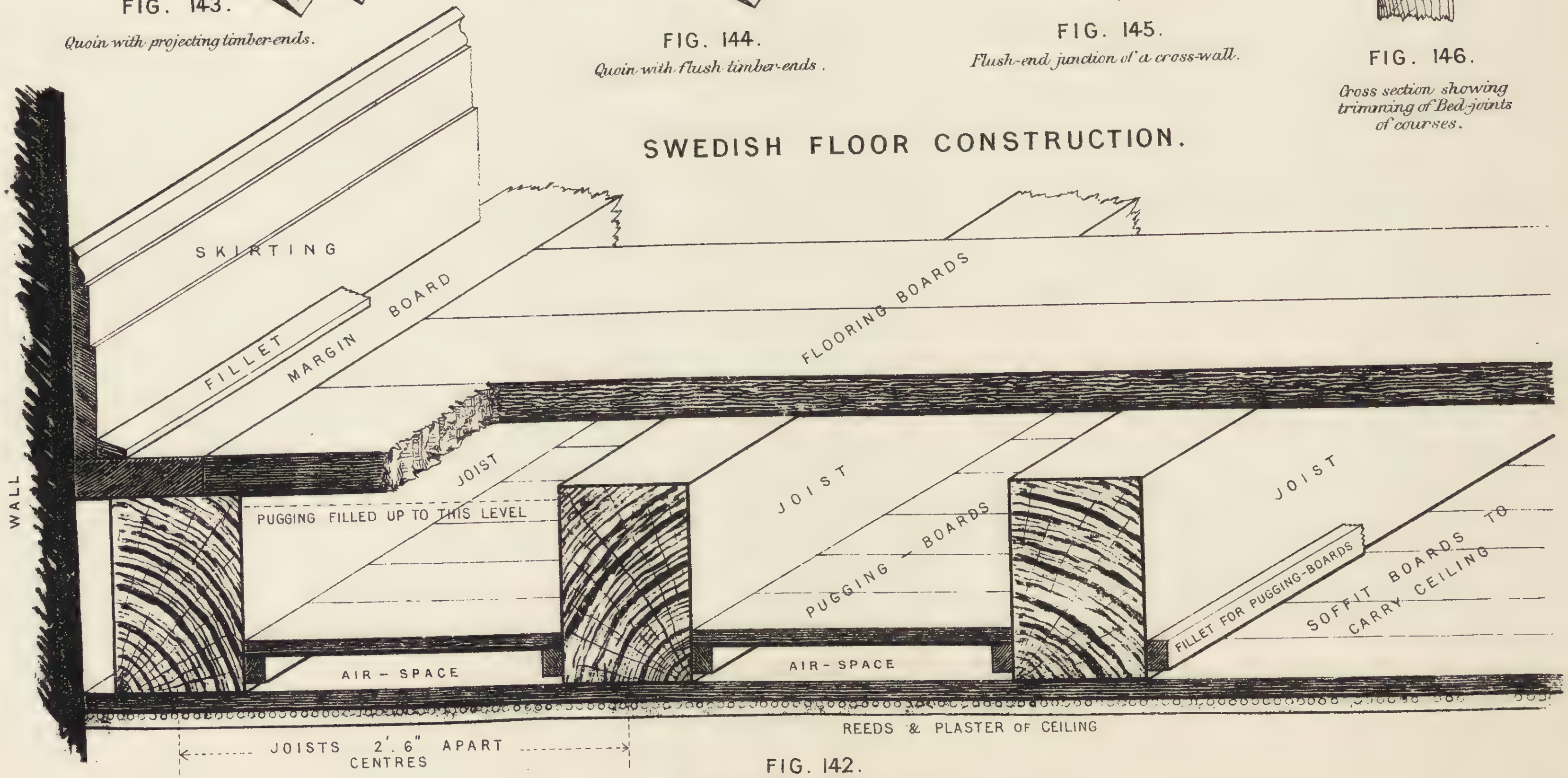
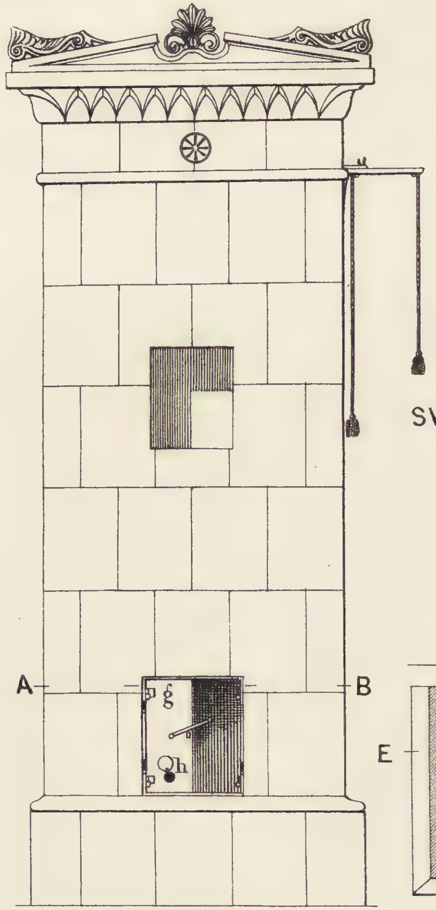


FIG. 142.
Scale of 1¼ inch to a Foot.

C.F. Kell. Photo-Litho London. E.C

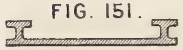
IX. NOTES ON DOMESTIC BUILDINGS IN SOUTHERN SWEDEN. (liv)

SWEDISH TILE STOVE.

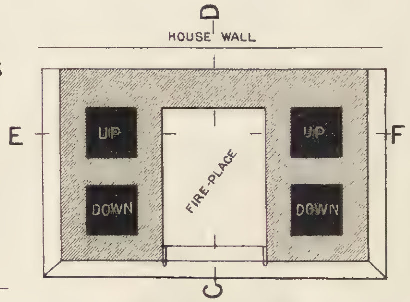


ELEVATION.
FIG. 148.

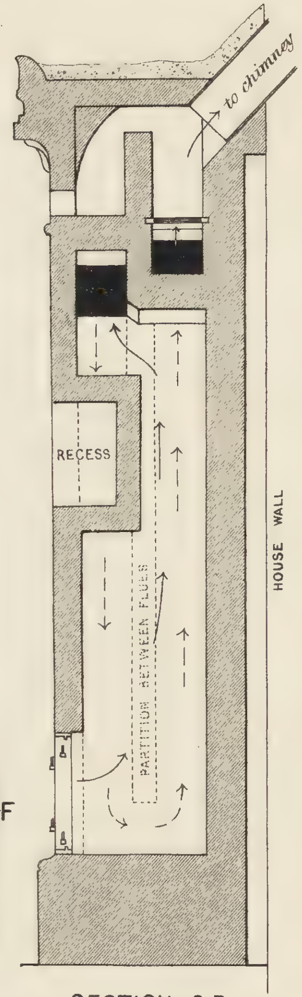
FIG. 151.



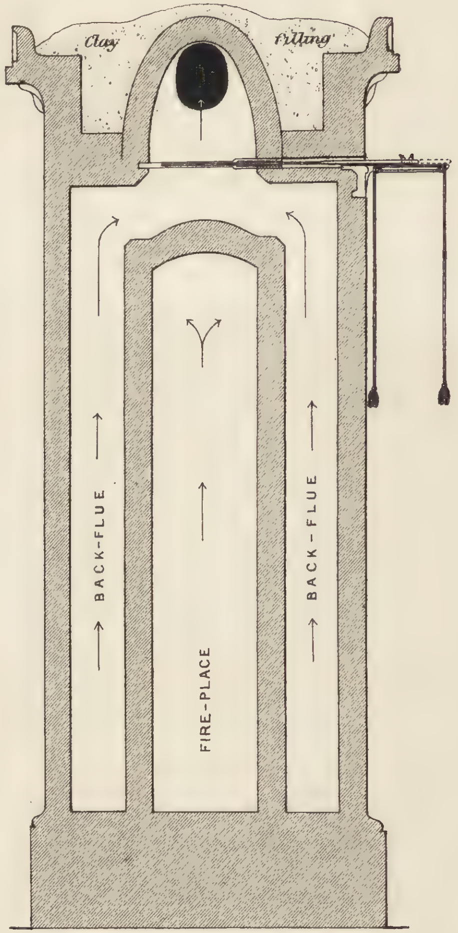
SECTION OF TILE



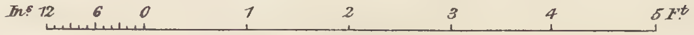
PLAN AT A-B
FIG. 147.



SECTION C-D
FIG. 149.



SECTION E-F
FIG. 150.



Scale of Feet.

C F. Kell. Lith 8, Castle St. Holborn, London. E.C.

X. THE CISTERCIAN ABBEY OF MAULBRONN, WÜRTEMBERG.

By Charles Fowler, *Fellow*.

[Read on Monday, 28th May 1883, Horace Jones, *President*, in the Chair.]

ONE of the most interesting Papers ever read before the Institute was, I think, that by the late Mr. Edmund Sharpe, on the general subject of the Cistercian Abbeys. In that Paper * the Abbey of Maulbronn is briefly mentioned. A number of plans, and Maulbronn amongst them, were on that occasion exhibited by Mr. Sharpe, and will be found reproduced in his book on the Architecture of the Cistercians,† which unfortunately was never completed. The general subject having been so ably treated, I intend to confine myself to a more detailed examination of this one example only. It will be seen from Mr. Sharpe's collection of plans that Maulbronn is one of the largest of those illustrated; and it is, I believe, without exception, the one in which the buildings are in the most perfect state of preservation.

In the beautiful and fertile but secluded valley of the Salzach, opening to the south-west, sheltered by surrounding hills, well wooded and of considerable height, the shrewd old monks selected a site admirably adapted for their purpose, and about the year 1147 commenced the building of the Abbey of Maulbronn. The site is a peculiar one, near the head of the valley and at its narrowest point; so narrow is it, indeed, that the hill on the north side had to be cut away in order to form the moat which surrounds the whole inclosure of the monastery, and on the south side the hill rises sharply from the outer edge of the moat, so that from the modern road which is formed there you look down upon the whole of the buildings. To the east of the monastery inclosure the valley is crossed by a high dam, which the monks constructed in order to form a large lake, thus securing a plentiful water-supply and at a considerable elevation, always a matter of careful consideration with the monks of this Order.

For the few historical notes on the Abbey with which I propose to trouble you I am indebted to a very careful monography by Dr. Edward Paulus, Professor of the Theological Seminary, which now occupies the monastic buildings. From the same source I have taken the plans and elevations, without the assistance of which I could hardly hope to make my subject interesting.‡ I carefully compared the plans and details given by Dr. Paulus with the buildings, and took some further measurements and details.

* See the Transactions, 1870-71, page 189.

† See *Illustrated Papers on Church Architecture, No. II.* April 1876 (*Cistercian Architecture*), page 36, and the plate of plans of 21 Cistercian Abbeys.

‡ It was chiefly from the description and plans of the Abbey, given in Dr. Paulus's little work, that I was induced to visit the place, which, although not at all difficult of access, is so completely off the beaten track that it is probably little known to English architects. Looking through the strangers' book at the small inn, for several years back, I did not see a single English name. One especial attraction to me was the statement that the buildings were in a remarkably good state of preservation, owing chiefly no doubt to the fact that they had never been disused, as the dissolution of the monastery was at once followed by the establishment of the seminary; in fact, they almost co-existed for a short time. All the principal buildings remain, and are almost unaltered, at any rate in the lower storey; the upper storeys have suffered more from the alterations made for the altered uses of the seminary. There has been some restoration; but, as far as I could discover, it has consisted only in partial repairs judiciously carried-out: there has been no attempt to reconstruct some parts which are more or less ruined.—C. F.

The founder of the Abbey appears to have been a certain Walter of Lomersheim, but the ecclesiastical patron was Günther, Bishop of Speyer, who played the most important part in the work, and procured such endowment for the monks as enabled them to commence their buildings about 1147. The date of the foundation of the church is not given, but it appears not to have been completed at Bishop Günther's death in 1161, the consecration not taking place till May 1178, by Arnold, Archbishop of Trêves. Günther was, however, buried in the church, and his successors in the See of Speyer appear also to have greatly favoured and protected the Abbey, so that the monks were enabled to proceed rapidly with their extensive buildings. As to the dates of the erection of the various parts, there seems to be very little documentary evidence, which is the more remarkable, as Dr. Paulus appears to have discovered very full materials for the general history of the Abbey. We learn, however, that about 1360 the fortified wall inclosing the whole monastery was either built or rebuilt, on account of the general state of insecurity of the country at that period. The monastery appears to have attained the highest point of its prosperity in the middle of the fifteenth century, after suffering a good deal during the religious wars preceding the Reformation, during which time the monks were several times turned out and reinstated; and finally, in 1558, a protestant abbot (Valentine von Beilstein) was elected, and he shortly afterwards converted the monastery into a theological seminary, for which purpose it continues to be used at the present time.

The dates of the principal buildings as now existing must be inferred chiefly from their style, as I can find but little documentary evidence of their erection. There appears to have been a distinct rule, according to which the monasteries of this Order were laid-out; and this was always adhered-to, with one important difference, that in most cases the monastic buildings were placed on the south side of the church, but in some, as at Maulbronn, on the north side, probably determined by the nature of the site. Although the existing buildings at Maulbronn range, according to their styles, from the middle of the twelfth century to the middle of the sixteenth, there is evidence that the whole plan must have been laid-out at or soon after the commencement, and was even probably carried-out in all the important points within at least the first century after the foundation of the church, and that the portions now showing later styles were either subsequently rebuilt, or perhaps were at later dates built into the spaces designated for them in the original plan [Illustn. lv]. On this point I shall have a little more to say when comparing Maulbronn with some other houses of the Order.

The Church.—The churches of the Cistercians were generally on a large scale, and simple in architectural detail. This description thoroughly applies to that of Maulbronn; the plan is of the usual Cistercian type, the long nave with aisles, consisting of ten bays, uniform throughout up to the crossing, which consists only of a narrow bay, beyond that the square sacrarium with square east end. The total length is 210 feet between the east and west walls; the internal width, 68 feet; that of the nave, 28 feet between the piers; the height of the nave to the original flat ceiling 62 feet, and in the aisles 28 feet. Externally the church appears to have transepts of the same height as the nave, but internally they are reduced to a low aisle with three eastern chapels on each side of the sacrarium; the arches opening from the cross aisles, as they may be termed, into the nave are very small and low, as seen in Illustn. lvi [fig. 153]. Over these cross aisles and chapels on each side there is a large chamber, that to the north formed the library, approached from the monks' dormitory; to that on the south side there is a spiral

staircase from the church, but the use of it is uncertain.* In the north transept a broad and easy flight of stairs leads to the monks' great dormitory. A solid stone screen divides the nave into two unequal parts, so that four bays west from the crossing are inclosed for the monks' choir, the floor of which is raised only one step above the general level. It will be observed that there is no central opening through the screen. The screen may originally have been continued across the aisles, and in the north aisle there is one of later date at present existing, but in the south aisle there is not now any evidence of such a screen. The piers of the nave are simply square in plan, with attached half-shafts on east and west faces only (those next the aisles were added at the date of the vaulting), the capitals and bases boldly moulded. The windows have only deep splays on both sides, except those remaining on the north side of the sacrarium, which are rather elaborately moulded *externally* [Illustn. lvi, figs. 153, 154].

The only parts of the church originally vaulted were the sacrarium, the narrow bay at the crossing, and the aisles and chapels in the transepts. The vaulting [fig. 153] is in the simplest form, with ribs of bold profile or simply chamfered. A flat ceiling originally covered both the nave and aisles: a portion of this still remains in the south transept, from which I was able to take measurements. It is formed with wrought fir ribs or plates, $6\frac{1}{2}$ inches by 4 inches, *and spiked to the under side of the tiebeams*, at a distance of 4 feet apart, there being one, of course, next to the wall; these ribs are chamfered and grooved to receive the boarding, which, however, no longer exists. The preservation of this remnant of the original ceiling is probably due to the circumstance that the vaulting with which the remainder of the church was covered at a later period was not carried-out in the south transept. The rib next the wall is also visible in some places over the nave. These remains of the ceiling are particularly interesting, as showing that the roof to which they are attached is the *original roof* of the twelfth century. The roof is in remarkably good preservation; it is constructed of fir, and is in the same form throughout. The scantlings are, tiebeams 17 inches by 10 inches, one to each rafter; the rafters 11 inches by 6 inches, and 3 feet 2 inches apart in the clear; collars 9 inches by $4\frac{1}{2}$ inches; struts 6 inches by 9 inches, these are halved on to the side of the rafters; wall-plates 17 inches by 9 inches, halved down for the tiebeams, all put together with *fir* pegs. All the timbers are axe-dressed and well squared. The battens for tiles are nailed to the rafters, and are very slight considering the bearing (only 3 inches by 1 inch). Possibly they are not the original ones, though they appear to be. The original doors at the west end of the church still exist; they are covered outside with thick parchment, which was painted, and over which is fixed the elaborate ironwork; their preservation is probably due to their being protected by the vestibule. Of the original fittings of the church nothing else remains.

In the year 1424 Abbot Albrecht IV. caused the whole of the church to be vaulted, which was carried-out by the lay-brother Bertholt; this necessitated the construction of flying buttresses to the nave, springing from piers carried-up on the outside walls of the aisles, and finished with crocketed pinnacles [fig. 154]. At the same period arches were cut through the south wall of the church, and a series of ten chapels built. The two canopied altars in the nave probably date from the same, or a somewhat later, period. Of about the same date are the

* It may have served as the sacristy, for which there is no space in the position it usually occupied, adjoining the end wall of the transept.—C. F.

oak stalls which surround the choir; they are elaborately carved, and are a fine specimen of the work of that period. The insertion of the large traceried windows on the east and south sides of the sacrarium must also date from the early part of the fifteenth century, for in a fresco on the south side of the choir, dated 1424, and representing the presentation of the church to the Virgin by its founders, Bishop Günther and Walter of Lomersheim, the east end of the church is represented with the window as now existing.

The exterior of the church is plain almost to baldness, but the masonry is excellent; the moulded work and details are almost as sharp as when they were executed. There are, according to a rule of the Order, no towers, but over the crossing there is a wooden bell-turret, with a spirelet; this, however, appeared to me not to belong to the original construction of the roof of the church.

The Galilee porch or vestibule, at the west end of the church, is a very interesting feature and a good example of the transitional style of the thirteenth century, which produced so many fine works in western Germany. It dates from after 1220, and consists of three bays, each about 24 feet square, and nearly the same height, with simple cross vaulting; a peculiar effect is produced from the springing of the diagonal rib being several feet lower down than that of the wall ribs. Externally the centre bay shows a double doorway, and the side bays have double window-openings, again subdivided by slender shafts barely 6 inches in diameter. The details are very good, the mouldings of the window-heads particularly delicate; the effect of the interior, looking outwards, is most picturesque.

The Cellar.—The remainder of the more-strictly ecclesiastical buildings of the monastery are grouped round the cloisters on the north side of the church. The range on the west side consists of a two-storeyed building extending northwards about 208 feet. The first part next the church is called the great cellar, 67 feet long and 35 feet wide, covered with heavy ribbed cross vaulting; the floor is sunk about four feet. There is a large entrance doorway in the *outside* wall, and a small door in the passage leading to the cloisters. This cellar is a peculiar feature at Maulbronn, and is not found in any other of the principal houses of the Order described by Mr. Sharpe. It will be observed that it is the only one of all the buildings surrounding the cloisters which has an entrance from the *outside.* Next to the great cellar is the principal entrance to the cloisters, by a passage-way 12 feet wide.

Lay-Brothers' Refectory.—The remainder of this building on the ground floor forms the refectory for the lay-brothers, or *domus conversorum*, a fine hall, 118 feet long and 35 feet wide, but only 17 feet 6 inches high. It is divided down the centre by a row of seven coupled columns, from which rises the vaulting in circular section, without ribs; the small windows, in walls more than 3 feet thick, light the interior very imperfectly. There are two hatches in the east wall opening into the adjoining kitchen or buttery. The upper storey of this range contained the dormitory of the lay-brothers; it was not vaulted. The interior has been entirely altered, so that the original arrangements cannot now be traced; the roof, however, seems to be of the original form. It is singular that there is no trace of the original staircase to the upper storey. The general style as well as the details of this range of buildings show that it is nearly of the same date as the church; and, in fact, an inscription on the base of a pier near the principal entrance gives the date of 1201. The carved capitals of the coupled columns in the lay-brothers' refectory have, however, a decidedly transitional character,

different from anything in the church. The vaulted cloister on the outside of this building is fifteenth-century gothic, and the staircase at the north end, of about the same date, leads to the halls and rooms of the upper storey now occupied by the seminary.

Monks' Refectory.—The monks' refectory, marked 25 on the plan [Illustn. lv, fig. 152], is the finest building of the whole group; it stands in the usual position about the centre of that side of the cloisters which is opposite the church, in this case the north side. The dimensions are 89 feet long, 38 feet broad, and 33 feet high to the crown of the vaulting. It is divided by a row of seven columns down the centre, which are alternately 1 foot 8 inches and 2 feet 5 inches in diameter. The vaulting is sexpartite with circular arches, the smaller ones being stilted to the necessary height, producing rather a singular effect. The details of this fine hall are in the best style of the transition, and the whole is in almost perfect preservation, though I believe the only restoration has been the glazing of the windows and the renewing of the pavement. There being no upper storey to this building buttresses were added to the side walls to take the thrust of the vaulting. On the east side of the hall is the winding-stair leading to the pulpit or gallery for the *lectio mensæ*, but the pulpit itself has unfortunately disappeared. The entrance doorway to the refectory is singularly placed in the centre of the south end, so that it is in the line of the columns down the centre of the hall. There is a large hatch in the west wall opening into the kitchen or buttery of which there are no remains, and it is difficult to understand how a kitchen of sufficient size for so large an establishment can have been built in the only space available; the evidence of the hatches in both of the refectories seems, however, to be conclusive, unless it may be assumed that one of the large rooms to the north-east of the cloisters formed the kitchen, and that the room between the refectories was only a buttery for serving the viands. The kitchens of the houses of this Order were, however, always very small. The staircase turret against the west wall of the monks' refectory indicates that there was an upper storey to the kitchen.

Hot Air Room.—In the angle between the monks' refectory and the cloisters is situated the only warmed chamber in the whole of the abbey buildings. The lower storey consists of a small vaulted chamber or stove in which the fuel was burnt, as the walls and vault show; the upper storey, approached from the staircase in the angle of the cloisters is vaulted, and has a stone floor bedded on the solid vaulting of the space below. Through the vaulting there are twenty holes disposed [Illustn. lvii, figs. 155, 156] about 6 inches square up to within 3 inches of the floor, the remainder being formed with stone rings or tubes 4 inches in diameter. The heated air from the chamber below rising through these tubes must have made the upper chamber tolerably hot, though part of the warmth escaped through an opening into the monks' refectory. The chamber is 23 feet by 21 feet. There is a stone sink along one side, seeming to show that it was partly used as a lavatory. The whole of the construction of this chamber appears to be of a later date than the monks' refectory, the opening into which is precisely the same as the other windows, but whether originally built for an open window and subsequently utilized for the purpose described, it is impossible now to determine.

The block of buildings to the north-east belongs also to the early period, at least as regards the lower storey; the original purpose of these buildings it is now difficult to determine, as they have been so much altered, but they probably contained the monks' day room or *domu monacorum* and the flagellation chamber. A similarly-placed block of buildings is to be found

in other houses of the Order, and is usually the *domus monacorum* with the dormitory over; the three projecting wings, of which this is one, form, however, a distinct feature of the plans of most of these monasteries.

The Cloisters.—These are nearly square, 90 feet by 91 feet in the clear, six bays on each side, but the sides are all different and of different periods. The earliest and far the best portion is the side next the church (the south side), including one bay of the east and west sides; the details here are almost identical with those of the Gallilee porch, and therefore the construction may be dated about the same time. The vaulting is sexpartite, with very boldly-moulded ribs springing not from shafts against the outside wall, but from corbels on the side of the church in order to give room for the uninterrupted seat along this wall, which appears to have been customary in houses of this order; assembled here before vespers the monks listened to the reading of the rules of the Order by the prior or one of the monks. The seat, usually in stone, is however wanting at Maulbronn. The north side of the cloisters is partly of the same period; the north wall was probably built at the same time as the refectory, but the inner wall was either not completed till much later or subsequently rebuilt in the fourteenth century. The beautiful fountain-house opens out of this side of the cloisters exactly opposite the entrance to the monks' refectory, and the view into it from that doorway is most picturesque; up to the sills of the windows it is circular in plan, 20 feet in diameter, and this part may have been built at the same date as the refectory, for the doorway was originally circular-headed, though it has been altered, and the upper part is nine-sided, fourteenth-century work; the transition from the circular plan to the polygonal superstructure, and the peculiar position of the entrance door under an angle, give rise to a curious piece of construction. The fountain is restored. The west wing of the cloisters is of late thirteenth-century work with very good details. The east wing is the latest in date—first half of fifteenth century—and is the least interesting; the entrance to the cloister garden is on this side. The great dormitory of the monks extended over this wing, the other three sides had originally no upper storey. A very picturesque vaulted staircase in the north-east angle leads to the great dormitory and other parts of the upper storey. The window-openings on the north, south and east sides of the cloisters appear to have been glazed, but on the west side the stonework is not prepared for glass, though it is difficult to understand the reason for the distinction. According to original rules of the Order none of the window-openings were glazed, but in later times this rule seems to have been relaxed.

Chapter-House.—This is a fine vaulted hall, in the centre of the east cloisters, 47 feet by 27 feet 6 inches. The elaborate star-vaulting springs from three columns, and is characteristic of the period, early fifteenth-century. The side next the cloisters is pierced with large windows and double entrance, but not closed with doors, nor were the windows glazed. On the east side there is a large bay-window, the floor of which is raised nearly 3 feet, being vaulted underneath with a segment-headed opening into the chapter-house, and the space is also lighted by some small windows. I do not know the object of this singular arrangement, but there is structural evidence that it is a later insertion; there is no appearance of steps up to the raised floor. The erection of so important a portion of the abbey as the chapter-house can hardly have been delayed to the late date of the existing building which therefore most likely replaced an earlier structure, the probable style of which may perhaps be inferred from

that at the Abbey of Bebenhausen, not far distant, where the chapter-house is one of the earliest buildings, similar in style to the lay-brothers refectory at Maulbronn. It will be observed that the principal axis of the chapter-house is north and south, so that the east wall does not project beyond that of the adjoining buildings; in most of the important houses of the Order the chapter-house is turned the other way, so that it projects eastwards.

Parlatorium.—On the north side of the chapter-house a vaulted passage leads to the parlatorium, 88 feet long, 20 feet wide and about the same height; the south side opens by a range of large traceried windows on to the abbot's garden, so that this long vaulted gallery formed a pleasant walk, where the monks were allowed to break the general rule of silence enjoined by their Order. An inscription over the door of the spiral staircase in the south-west angle gives the date of 1493 for the completion of this building; the unbroken wall of the north side and east end has remains of fresco paintings; at the east end this gallery communicates with the abbot's house. The upper storey, similar to the lower and similarly vaulted, formed a gallery of communication from the abbot's house to the great dormitory.

Abbot's House.—The Abbot was provided with a large house to enable him to entertain distinguished guests; at Maulbronn the house was in great part rebuilt by Abbot Entenfuss (Duckfoot), 1512, and his canting crest, a duck's foot holding a crozier, is carved on one of the pillars of the great hall; the Romanesque arcade at the back of the great hall shows that the original building belonged to the earliest buildings of the abbey. The building of Entenfuss is chiefly remarkable for its size (more than 100 feet long and 50 feet deep), the principal front has a picturesque oriel crowned with a lofty spire. The great hall is about 70 feet by 35 feet, embracing the height of two storeys, the floor above being supported on six stone columns of rather peculiar design. The lighting of the hall must have been deficient, as the windows are very small. This building is now converted for residences of masters of the seminary. Some walls and foundations to the west of the abbot's house show that the original building must have been much more extensive.

The Walls.—The whole group is encircled by a fortified wall and moat, the latter revetted with masonry on both sides and capable of being flooded to a considerable depth. On the north side, where the moat is narrowest, the width is about 30 feet. The precinct of the monastery must doubtless from an early date have been protected by some inclosure, but the walls with the towers as now existing appear to have been constructed between 1361 and 1441, the latter date being recorded in an inscription on the tower at the north-west angle. The wall is about 6 feet thick, with loopholed and battlemented parapet forming a complete "chemin-de-ronde" protected by a wooden roof, remains of which are still to be seen. The entire circuit of wall still remains, except a portion on the north side.

Towers.—There were strong towers at rather wide intervals: that at the north-west angle remains perfect with its tall pyramidal roof, the rest have been all more or less altered; the whole is constructed in bold masonry with large blocks, and produces a very striking effect. The only entrance to the precinct of the monastery was through the fortified gateway at the south-west angle. Here there was a drawbridge, the arrangements for the portcullis being visible in the masonry: the upper part of the gate-tower was probably similar to the angle-tower just mentioned. Of the inner gate there are only small remains: the position is indicated in the plan [Illustn. lv]. On the right of the entrance was the customary chapel of the Trinity,

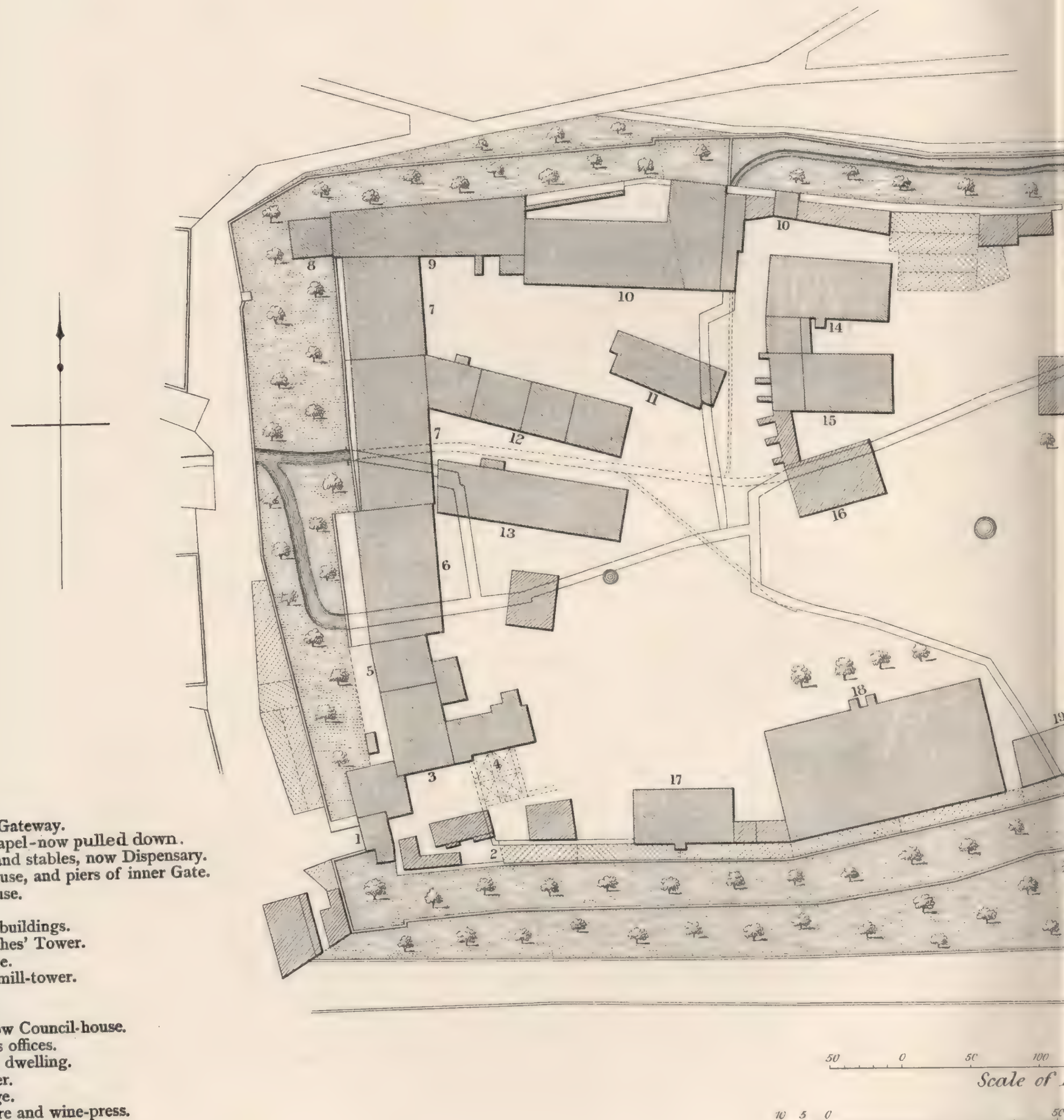
of which now there are only slight remains, as it was pulled down in 1813. On the left was the guest-house, with stables attached. The range of buildings on the west side were the farm buildings of the monastery, and dotted about the great inclosure are the various buildings required for the administration of the immense possessions of the Abbey. The Abbey mill, on the north side, is the most noteworthy of these: it has not been much altered since the fourteenth century, and seems to be still in full work, though the water-power has been supplemented by steam; the lower storey of all the buildings is mostly the original structure of solid masonry, but the upper storeys are in half-timbered work, apparently of the sixteenth century and later. The effect of the whole group is exceedingly picturesque.

Barn.—The most striking building in the precinct is the great barn and granary on the south side, rebuilt 1580. It is 156 feet long by 80 feet wide; the gable-ends show seven storeys above ground, and under a portion there is a vaulted cellar of great extent. The walls are 4 feet 6 inches thick on the ground floor, and 4 feet up to the eaves of the roof; the principal beams of the floors are 20 inches by 10 inches.

Water-Supply.—The Abbey was well supplied with water. For general purposes this was brought from the artificial lake to the east, the average level of which is as high as the roofs of the buildings; large conduits in masonry conduct this water to every part of the monastery, as shown on the block plan [Illustn. lv]. The drinking water for the monks was brought from springs in the hills at some distance, and was conveyed in leaden pipes to the fountain in the cloisters, where it still runs in a never-failing flow. After serving all the purposes of the Abbey the water runs off by the natural stream down the valley. It would lead me too far to describe the elaborate system of drainage and irrigation which was established by the monks for some miles around the Abbey, and the series of fish-ponds formed at different levels for the supply of the monks' favourite diet.

It only remains for me to say a few words in comparing this with other houses of the Order. I have already referred to the great cellar as an unusual feature not seen in any of the English or French examples that I know. In one instance in Germany, at Bebenhausen, near Tübingen, in Würtemberg, there is a somewhat similar arrangement, though it is not supposed to have been used for the same purpose, but as the Parlatorium; the floor is, however, sunk, though only three steps. In nearly all the English examples, the lay-brothers' refectory immediately adjoins the church. Then the entrance passage to the cloisters on this side is, so far as I know, never found in the English examples, though it exists in some other cases both in France and Germany, as, for example, at Clairvaux and Bebenhausen. The unusual arrangement of the chapter-house I have also described, but it is similar to that at Bebenhausen, where the chapter-house is one of the oldest buildings; so also is the position of the great dormitory being carried over the chapter-house, the library being otherwise provided-for at Maulbronn in the upper storey of the north transept. At Bebenhausen the continuous stone seat in the side of the cloisters next the church still exists, and I may here add that Bebenhausen is not included in the long list, given by the late Mr. Edmund Sharpe, of 46 monasteries of the Order, the greater part of which he had personally visited.

X. THE CISTERCIAN ABBEY OF MAU

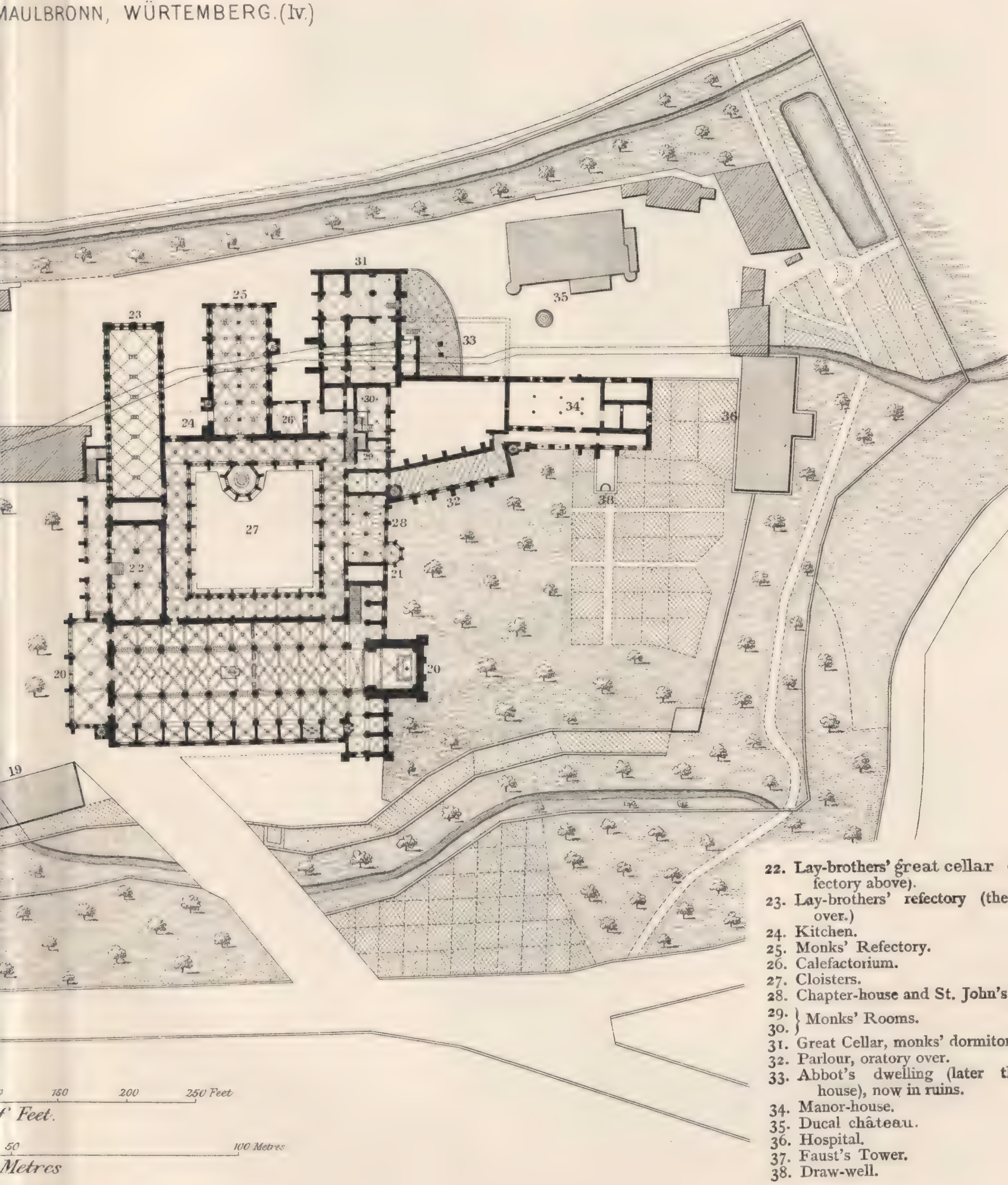


1. Entrance Gateway.
2. Trinity chapel-now pulled down.
3. Hostelry and stables, now Dispensary.
4. Matins-house, and piers of inner Gate.
5. Coach house.
6. Smithy.
7. Old farm-buildings.
8. The Witches' Tower.
9. Cow-house.
10. Mill and mill-tower.
11. Barn.
12. Granary.
13. Mews-now Council-house.
14. Steward's offices.
15. Servants' dwelling.
16. Exchequer.
17. Cooperage.
18. Fruit-store and wine-press.
19. Vineyard offices.
20. Church.
21. Sacristy?

FIG. 152, GENERAL PLAN OF THE AB

E OF BRITISH ARCHITECTS, 1882-83.

MAULBRONN, WÜRTEMBERG. (IV.)



22. Lay-brothers' great cellar (winter refectory above).
23. Lay-brothers' refectory (their dwelling over.)
24. Kitchen.
25. Monks' Refectory.
26. Calefactorium.
27. Cloisters.
28. Chapter-house and St. John's chapel.
29. } Monks' Rooms.
30. }
31. Great Cellar, monks' dormitory over.
32. Parlour, oratory over.
33. Abbot's dwelling (later the Bishop's house), now in ruins.
34. Manor-house.
35. Ducal château.
36. Hospital.
37. Faust's Tower.
38. Draw-well.

ABBEY AND ITS DEPENDENCIES.

C. F. Kell, Lith. 8, Castle St. Holborn, London, E.C.

X. THE CISTERCIAN ABBEY OF MAULBRONN, WÜRTEMBERG. (lvi.)

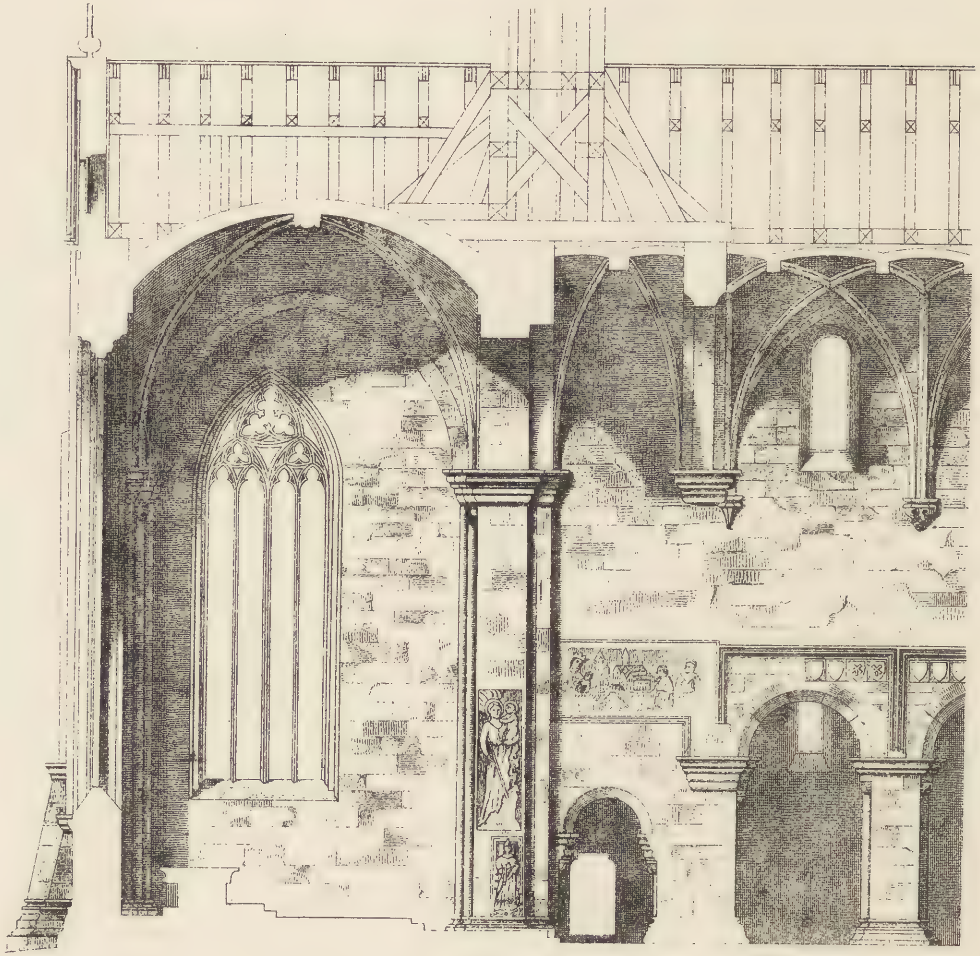


FIG. 153. LONGITUDINAL SECTION THROUGH EAST END OF CHURCH.

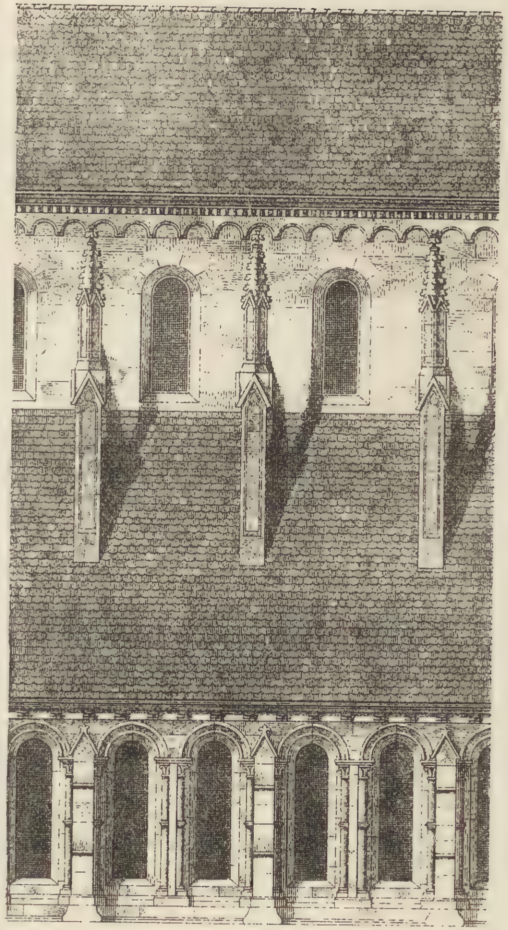


FIG. 154. SIDE ELEVATION OF PART OF CHURCH.

Scale of Feet.

10 5 0 10 20 30 40 50 feet

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

X. THE CISTERCIAN ABBEY OF MAULBRONN, WÜRTEMBERG. (lvii.)

FIG. 156. SECTION AT A.B.

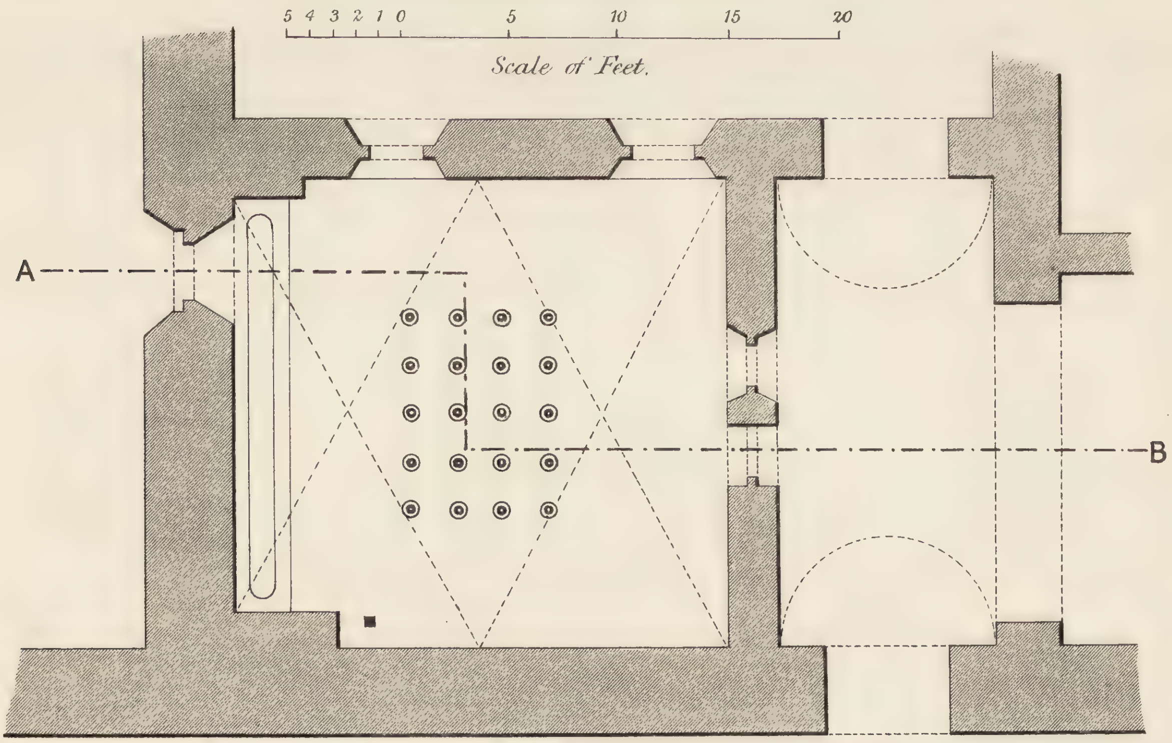


FIG. 155. PLAN OF HOT AIR CHAMBER.

(MARKED 26 ON GENERAL PLAN, lv.)

XI. PRESENTATION OF THE ROYAL GOLD MEDAL, 1883,

To Francis Cranmer Penrose, M.A.(Camb.), *Past Vice-President.*

[Presented on Monday, 11th June 1883, Horace Jones, *President*, in the Chair.]

THE PRESIDENT.—Gentlemen, It is needless for me to enter into the history of the Royal Gold Medal, the gift of Her Most Gracious Majesty, which your President has the honour of presenting in the Queen's name to your nominee. This duty is always and under all circumstances an honour and a pleasure, but on this occasion a double pleasure, from the recipient being a well esteemed and well respected friend and associate of my own, namely Francis Cranmer Penrose, the professional adviser to the Dean and Chapter of St. Paul's Cathedral, and a well known and highly appreciated member of our profession, a member of the Society of Dilettanti, and a Past Vice-President of this Institute.

The youngest son of the late Rev. John Penrose—whose descent may be easily traced by the old adage, "By tre, pol and pen, you may know the Cornishmen"—who was himself a distinguished Oxford scholar, and who held preferment in the County of Lincolnshire, our distinguished colleague was brought-up near the venerable Cathedral of Lincoln, and he was afterwards a scholar at Winchester, two localities where he may readily have imbibed, and no doubt did imbibe, a taste for our art, and a love for that charming product of our own country, "English Gothic," for which I, from personal knowledge, can vouch. Yet it did not prevent the prosecution of his studies in other styles and in other lands, especially in classic Greece, studies which have rendered him one of the authorities of the day, and contributed in no small degree to your selection of him for this honour.

Our friend and colleague entered at Magdalen College, Cambridge, after he had worked, you may be sure industriously and advantageously, in the office of the late Edward Blore, the architect, who, like some others, changed the *burin* for the pencil, and I believe he also obtained much practical knowledge in the offices and workshops of the late William Cubitt. He must in no slight degree have distinguished himself at Cambridge, for on his taking the degree of B.A. he received the honourable distinction of Travelling Bachelor, in recognition of his acquirements and character. He travelled for a considerable period in France, Germany, Italy and Greece, being in Athens in 1845. On his return, in February 1846, he read an interesting Paper to the Institute on "The curved lines of the Parthenon."* But the eager student was not satisfied to remain with his then store of knowledge; he revisited Athens, and continued his studies and researches there till 1847. This visit, I believe, of Mr. Penrose to Greece, was in consequence of an offer made by him to the Society of Dilettanti, and accepted by them, after being declined by the trustees of the British Museum, that he would, after providing himself with the necessary instruments for the verification of his theories, reside and give his services for several months at Athens, and afterwards lay before the Society the original copies of his researches and investigations for publication, which he did, and in 1851 the Society published the result of his labours in the magnificent work known as *The Principles*

* Mr. Penrose's first Paper on this subject was preceded by a pamphlet written by Mr. John Pennethorne, entitled *Elements and mathematical principles of the Greek architects and artists.* 8vo. Lond. 1844.

of Athenian Architecture, a copy of which, presented to the Institute by the Society, now lies on the table. He also communicated to the Institute a valuable Paper, entitled " Optical and Geometrical Corrections of the Greek Architects."

In regard to those refinements, permit me to remind you that though the curvature in the Parthenon is alluded-to by Vitruvius, it seems to have received no remark until 1837, when Mr. John Pennethorne (a brother of the late Sir James), mentioned the fact of its existence to some friends, one of whom I believe mentioned it to Mr. Penrose, probably awakening in him a desire to investigate the subject, and his investigations, made at great expense and personal exertion, have not failed in their aim. They will be prolific, in the future, of important consequences to the architecture of this country, and indeed throughout the world. Mr. Fergusson has happily said in his latest work: " When Stuart first in 1762 " made known the beauties of Athenian architecture to his countrymen, it was felt to be a " revelation of something better than they had known before. . . . ." But, " although we " really *felt* the beauty of the style, it cannot be said that we understood exactly in what its " superiority consisted, till the publication of Mr. Penrose's book in 1851. He was the first to " put before us, in a scientific manner, the principles that guided the architects in the design " of the Parthenon." Such is Mr. Fergusson's mature opinion of Mr. Penrose's early investigations, which, to repeat the words used in this year's Report of the Council of the Institute, " have been supplemented at various times by communications to learned societies, " whereby Mr. Penrose has given enhanced value and attracted fresh attention to his original " work." One of these, on " St. Paul's and its appropriate decoration," was highly commended by Professor Cockerell, who was present at the lecture. In 1859 Mr. Penrose continued the subject in another Paper entitled " Various matters connected with St. Paul's Cathedral," and in 1871 he read a Paper on the " Decorations of St. Paul's Cathedral." Besides many improvements, and even alterations effected both inside and outside of the cathedral under his superintendence, he has been personally occupied, for a considerable time, with the vexed question of adequately finishing the masterpiece of the great English architect.

This is not the hour nor perhaps the occasion for me to enter into a long disquisition of all the various methods and forms by which the artists of Greece seem to have sprung, like Minerva from the head of Jove, fully equipped, fully armed and fully endowed, but I may perhaps utter one sigh of regret, that the architecture of ancient Greece is less cultivated now than it has been; perhaps I should better express my feeling if I said it was more neglected than it ought to be. I hope that ere long in that old, well-endowed and popular institution, the Royal Academy, it may regain some portion of the fame and attention that it formerly held in the days, not only of Stuart and Revett, but also when, in that assembly, Soane, Cockerell and the two Smirkes were names of weight and value. And now, Francis Cranmer Penrose, do I heartily and cordially offer you my felicitations and congratulations, not only in your receiving, but in your thoroughly deserving to be the recipient of the Royal gift, and not only in my own name, but in that of the Institute, I wish you long life, health and happiness.

FRANCIS C. PENROSE, M.A., *Past Vice-President.*—Mr. President and Gentlemen, the greatest honour which can be offered to a man in a working profession comes from the hands of colleagues and contemporaries—those who have known him for many years. This honour you have done me in nominating me for the reception of the Royal Gold Medal, which you—

Mr. President—have so kindly and in such flattering terms presented to me this evening, enhanced as the gift is by the approval of Her Most Gracious Majesty the Queen. It is also no small matter to be put on the roll of those distinguished men who in former years have received that honour, and I think particularly of the lustre it derives from the first name on the list, that of my venerated friend and predecessor at St. Paul's, Professor Cockerell. Imbued with these feelings, however inadequately expressed, I trust I may succeed in assuring you of my extreme appreciation of the honour which you have this evening conferred upon me. I wish I had been more worthy of your kindness and of the kindness which has been shown me on all sides, both in the congratulations received from many members and also in your kind reception of me this evening. I know that my professional works as an architect have not been on the scale that would have entitled me to the award of this medal; but I seem to have been invested in some degree with a representative character, that of an exponent of Greek architecture, and because I stand here as such exponent, I may allow myself to feel on somewhat firmer ground than if I rested on my own small merits. It was my fortune to have lighted upon what might be called an unworked mine in Greek architecture. It was surveyed indeed by Mr. John Pennethorne, who had been two or three years earlier than myself in Athens, and through whom I heard in the first instance of this most remarkable feature in Greek architecture to which reference has been made. The work you have mentioned was published more than thirty years ago. I have had many evidences of the favourable reception of that work, especially that which you have yourself quoted from Mr. Fergusson, and also from various people abroad as well as in England who have referred to it with satisfaction. I may mention also Mr. W. Watkiss Lloyd's extremely valuable theories on the proportions of Greek temples, for which it supplied the data, so that I trust it has not been without the value which you have so kindly put upon it. I have also reason to believe that the position I hold at St. Paul's is attributable to the same work, and a great honour I deem that position to be, as successor to Sir Christopher Wren, and more recently to Professor Cockerell. May I be allowed under these circumstances to say a few words on what I hold to be our proper relation towards the Greek principles in these days. I wish in the first place to assert one point—of which there were the germs in the President's kind address—that I am by no means exclusively Greek or classical in my own sympathies. I hold that that man who can only see beauty in one style has but an imperfect feeling towards the art of the architect. There is a central element in the art which is quite independent of any style. In the Greek, indeed, I think it can be demonstrated that it exists in its greatest purity, but it is also found in Egyptian, in the Romanesque, and pre-eminently in the early Gothic, much obscured no doubt in the later Roman and in the later Gothic, but reviving with great distinctness in the Italian Cinque-Cento. There can be but one central idea in architecture; the different styles, like most languages, have but one root. What is important to us is, to know how we should use the essential principle. A love of the Parthenon does not exclude, nay it ought to enhance, admiration for Lincoln, or Salisbury and Chartres. It may indeed make us fastidious as to such works as Henry VIIth's chapel, where there is great beauty of detail, but where the architecture is obscured in that detail. But the same feeling makes one quite as much, or more, fastidious towards degenerate Roman work such as that of Baalbec or Spalatro. No one ever spoke with more enthusiasm than Professor Cockerell—a Greek

among the Greeks—of the sculptured arcades at Lincoln and at Wells, and William Burges, whose mediæval sympathies are so well known, was always conspicuous in his appreciation of Greek art. The true object of the architect is with the business of the day; and he should endeavour from the guidance derived from the ancients to improve what he is every day called upon to do, by incorporating their principles, and rarely, if ever, having the opportunity of introducing anything bodily copied from antiquity. That object is not the real aim for our study. There is, however, plentiful reason for accurate investigation and careful measurement of ancient buildings, because by such examination only can one arrive at the true idea of the work in question. There is an old and well-known saying, but not the less worthy of acceptation, "go to the fountain-head," and those works which are really the fountain-head of architecture should be chiefly studied. Students should be recommended to economize their time by working especially at the buildings of the finest and most accepted periods, and passing by in a most cursory way such works as are in the first instance attractive for mere exuberance of ornament. The proportions are the first things to be studied. The members are also to be studied from the light they throw on those proportions, but not for the object of introducing ready-made details into our work. Your kind approval of what I did many years ago cannot, I think, fail to give great stimulus to others who may be engaged on similar works. To me I feel that it has given very great encouragement. Whilst I was at work in Athens, I had indeed pleasure in the thought that I might be able to bring forward something worthy of your bookshelves, though I had no idea or thought of the splendid reward to which it has led at your hands to-night; and I think I may also answer for my friend and coadjutor, whom I have the pleasure of seeing here,—Mr. Thomas J. Willson, without whose help I do not know that my work would have been at all satisfactorily performed—that he must have shared similar thoughts, and I feel sure that I may quote him also as an instance of one who can thoroughly appreciate my view of the perfect compatibility of the admiration of gothic and classical works, because he was brought from the immediate presence of Lincoln cathedral, the finest example in this country, to the Parthenon, and without being disappointed with the Parthenon. Mr. President and Gentlemen, I have only to conclude by thanking you most heartily for the extreme honour you have done to me in recommending me to Her Most Gracious Majesty for the award of the Queen's very beautiful medal.

EWAN CHRISTIAN, *Vice-President.*—I should like, with your permission, Mr. President, to say one or two words with reference to St. Paul's. It has fallen to my lot—and a very happy task it has been—occasionally to inspect the work which Mr. Penrose has been doing in the restoration of that building; and with regard to the steps of the western entrance, Mr. Penrose has shown how to apply, in new work, the principles learned during his investigations in Greece. I wish also to bear testimony to the very remarkable skill and reverential love which Mr. Penrose has exhibited throughout in the restoration of the cathedral. I do not believe that among all the surveyors (and there have of course been many of them since the time of the great architect) not excepting even our venerated friend of past years, Professor Cockerell, there has been one more diligent and worthy than Mr. Penrose, and I think he not only deserves our gratitude for the valuable book that has been laid upon the table this evening, but also for the practical work he has done in our great metropolitan cathedral.

XII. NEW COLLEGE FOR THE GAEKWAR OF BARODA, WITH NOTES ON STYLE AND DOMICAL CONSTRUCTION IN INDIA.

By R. Fellowes Chisholm, *Fellow*.

[Read on Monday, 11th June 1883, Horace Jones, *President*, in the Chair.]

A BRITISH architect in India finds several old styles indigenous to the country and admirably adapted to the requirements of past times. He may elect to practise, after the necessary amount of study, in one or other of those styles, or he may have brought with him a knowledge of one or more western styles sufficiently profound to design and superintend the construction, single-handed, of a building in all its details from foundation to finial. Having made his selection, again two paths lie before him: he may choose the comparatively easy archæological road, copying piecemeal and wholesale structures of the past, or he may endeavour to master that spirit which produced such works, and select, reject and modify the forms to suit the altered conditions. Style, as you are all aware, does not end with details; although details have a large share in creating a style, there is beyond detail a something which, for want of a better term, we call expression, a something which we all recognize, but find so difficult to clothe with suitable attributes: hence it appears to me that if an architect could, single-handed, design structures perfectly suited to modern requirements in India, the expression would be so much altered, that the building would scarcely be recognized as in any particular known style. Thus if we took the details of a northern type of gothic, and clothed a house with open colonnades of this character, or, what would be nearer the spirit of the old builders, if we deepened the buttresses, and roofed over the flying buttresses to form a kind of verandah, in either case the expression would be completely changed, and by whatever name we might call it I feel certain that future generations would class it differently. If this position be admitted, and if the matter ended here, I am not prepared to say, on economic and even artistic grounds, that the past indigenous styles of art are more suited to India than foreign importations would be, or that in the hands of a clever designer, with a powerful grasp of the subject, every phase of gothic and renaissance might not be made as suitable to the country as any eastern type; but the matter does not end here, for this is merely the paper part of the business. When the design is completed we have yet to deal with the work itself and with the workmen, the men who will actually leave the impress of their hands on the materials, and these men have an art-language of their own, a language which you can recognize, but cannot thoroughly understand. For this reason an architect practising in India should unhesitatingly elect to practise in the native styles of art—indeed, the natural art-expression of these men is the *only* art to be obtained in the country.

Now, I regret that I cannot give that unqualified and even rapturous admiration to the indigenous arts of India which seems fashionable in some quarters. The native arts, or many of them, are technically good, they are infinitely superior to the parodies of European art which one sees, and they are, moreover, entirely free from all trace of vulgarity, but to claim for these arts (I refer to the existing arts of India) a position among the matured arts of other countries will, in my opinion, only bring them into ridicule; on the other hand, there is a vast

art-power lying dormant among the people, an aptitude for performing fine work second to no nation but the Japanese, and when the theorist has made room for the practical man, this art-power will be a source of great national wealth to India.

With regard to the native styles of architecture I think *all* may be studied with advantage. At the same time I am constrained to remark, that it is not without feelings of apprehension I note the very picturesque and florid marble style of upper India finding favour with the public, and being copied in meaner materials, to the neglect of the less showy, purer, and to my mind equally beautiful sandstone works. In many of the marble works appearances only are considered, the art ceasing to be structural, and partaking of the elements of upholstery. In the cusped arch, for instance, supported by undercut columns, we have perfectly unobjectionable forms when used as ornaments only, but false structurally, for when certain dimensions are reached the ornamentation is antagonistic to the jointing of the stones. But the same feature in old sandstone possesses almost Greek severity. The voluted leaf capital and the increasing capacity of the column to sustain weight, the simple covering of the space by corbelling, and the delicate carvings on the ends of each corbel, all combine to form a feature equally beautiful, and without doubt more true than the marble. Looking closer and comparing the details of the two styles we find much of the marble work, though unquestionably beautiful, in reality debased Italian, in many cases meaningless, wooden and ropy, while the old sandstone work, though aiming lower, carries a consistency and unity throughout all parts of a building scarcely to be equalled in any other style; and yet from remarks passed not long ago in this room from gentlemen entitled to the highest respect, one would have thought the end and aim of art in India was, with a bundle of photographs in one hand, and three pieces of detail in the other, to revive wholesale in meaner materials this very florid marble art, the pictorial phase of eastern architecture.

In classing from an architectural point of view the old sandstone work above the marble work of upper India I must except the Taj Mahal. Here the architect, aided by the lustrous marble of Mucranah and the brilliant light of an Indian sun, set himself a problem almost the reverse of the usual one: not how can I produce great depth of shadow, but how can I make my deep shadows lustrous? Before I saw the Taj I was not favourably disposed towards it. It is in a certain degree irritating to be told that a single rose contains thirty-seven pieces of inlay, and that there are so many hundreds of these roses all exactly alike! but when, thinking of other things, the sunlit Taj burst suddenly on my view from the gloom of the great entrance gateway, so scenic and wonderful was the effect that for a moment I thought the whole thing a trick. Many who have seen the Taj have doubtless noted this curious scenic effect, though for some extraordinary reason travellers are advised to see the building during the morning or the evening, when the effect is of course at its minimum. The Taj is placed on a large platform of marble, not seen from the gateway, and this throws a strong reflected light back on the building; there are no deep projections, except the large recesses for the openings, which, by reason of their cup form, catch and transfuse an enormous quantity of reflected light. The windows, simple in general form, are composed of regular patterns, which a short distance off are lost, and merely render the apparent opening several shades lighter than openings would naturally be. All the other accentuations are produced by flat black marble inlay; the only dull leaden shadow in the whole building is that on the

underside of the dome, and this is caused in a great measure by the flat roof around it being cemented. As the watertight properties of cement on a flat brick roof are, if anything, inferior to ordinary chunam, it would materially add to the beauty of the structure to remove it, and to replace the original material. It is extremely difficult to estimate the key of two different hues of colour, but, as near as I could judge, the deep shadows on the building were in a higher key than the *lights* of the dark foliage before it, which no doubt was the architect's intention.

If I may be permitted to strain a comparison I should say that the marble works of upper India bear about the same relation to the sandstone works that late "perpendicular" bears to thirteenth-century work: in both the later periods we find the maximum of executive skill, and the minimum of what may almost be termed experimental design.

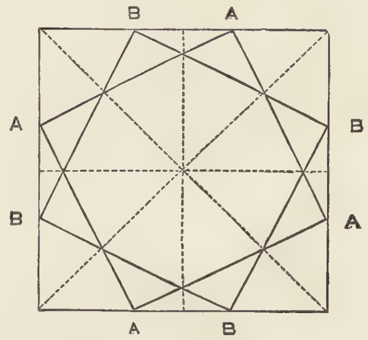
A general impression seems to prevail that most of the better civil work of India is Mohammedan, because it arose under Mohammedan influence. The fact is, the Mohammedans made free use of Hindu workmen, and adopted their forms in religious structures: hence much that is really Hindu passes for Mohammedan. Many of the geometrical patterns are undoubtedly so, and the texts from the Koran are so ornamental as to be sometimes mistaken for pure ornament. I may mention a curious incident in connection with this fact. Three or four months ago the chief Moulvie of the large mosque in Triplicane, Madras, waited on the Commissioner of Police, on what he stated to be a most important matter. When shown into a private room he produced in a mysterious manner a lady's dress, which he said he had purchased at a European shop for £5. The dress was encircled by bands of texts from the Koran, which he commenced in a most excited manner to read. One of the most sacred writings was at the bottom of the skirt, and, said he, "If any of your ladies ventured to drag that text through the mud, the faithful would tear her to pieces." These bands had undoubtedly been selected by some European designer solely for their ornate appearance. Nearly all the intricate incised ornament on the sandstone mosques appears in early Jain temples. The horse-shoe arch, surmounted with a pointed form, occurs in rock-cut temples, and in the Ruths at the Seven Pagodas. The bulbous dome is found over the relic in nearly every Buddhist cave, the corbelled and stilted pointed arch is found, as a form at least, sculptured on a column in a cave at Badami, dating anterior to the first Mohammedan invasion, and in searching among the sandstone works of Rajpootana, Gujerat and Kattiawar, little is found which did not originate with those princes of architects, the Jains.

There is still another matter connected with style in India which demands a special word, the question of materials. Until a comparatively recent date lines on a drawing in India meant simply the edges of plaster-work. In nine cases out of ten even honestly exposed brick is impossible, and in ninety-nine cases out of a hundred stone facing is too costly. If you wish to build truly, therefore, you must work in brick with stone dressings, or terra-cotta dressings, or with combinations of these materials. The architect who then elects to practise in a native style must, in ninety-nine cases out of a hundred, not only modify the style to suit his materials, but he must also teach his workmen how to use these materials; he must teach them the plastic arts, as well as glass painting, decorating and sundry other things. Such an undertaking, I need scarcely say, is the work of years.*

* I have been resident in Madras nearly nineteen years, and it was only during the past four or five years that I have been able to work with even a small degree of satisfaction to myself. I have now a sound face

The Baroda College is an attempt to work on the lines I have indicated, that is, to make native art and indigenous forms subservient to the conditions and requirements of the day. The materials of the new College are red brick, a beautiful satin grey sandstone, and red and green glazed terra-cotta. What will doubtless interest you from a practical point of view is the dome-work. I will describe the principal dome. The central hall is a square of 60 feet, recessed at one side for a senators' platform, and on the remaining three sides for a gallery, which projects on brackets 7 feet into the room. Thus the whole area of the room is, roughly, about 80 feet square. I adopted this form, because I found by experience that few ordinary speakers can make themselves heard beyond 50 or 60 feet [Illustn. lix, figs. 158, 159].

Mr. Fergusson* has pointed out the method adopted by the Beejapore builders for counteracting the thrust of a cupola by hanging weight on the inside, a principle which I have here carried into practice. The sides of the square are trisected equally, and if we letter the points A B—A B all round, and join the As and the Bs, we have two smaller squares intersecting each other. These lines form the centres of ribs of great arches, leaving an octagonal form in the centre, afterwards corbelled-out to the circle.



In this case I propose to leave the great eye permanently open, and to throw a light decorated cloth across it in such a way as to destroy excessive resonance and afford glimpses of the true dome from below. The recess at the north side measures 26 feet, and the distance between the central ribs 25 feet. This difference of 12 inches, and the supports for the ribs being corbelled-out, add materially to the lightness of the appearance [Illustn. lix, figs. 158, 159].

The true dome is, so far as I know, a novelty. The external diameter is 70 feet. The drum rests on a double ring of carefully dressed sandstone, cramped at the joints with gun-metal. The inner dome takes a curvature securing the greatest strength; the outer visible dome rests on this, as it were by sixteen intervening ribs, all the thicknesses being 18 inches only. We have thus sixteen chambers, and by opening the lower end to the outside and the upper end to the inside a very complete system of ventilation and lighting is secured. No centre was used during the construction, except to the angles of the false dome. The true cupola was turned ring after ring in brick from a very rough scaffolding. Three complete rings were turned daily. The dome from the roof contains 1,500 cubic yards of brickwork, including the four-angle domes which cover the square. The total weight is 2000 tons, and the pressure at the base about three-and-a-half tons per superficial foot. The cost in Baroda, exclusive of finial and ornate covering, was about £2000. All the domes were constructed in the same way; the smaller ones, covering a square of 16 feet, are only half-brickwork. The exterior of all will be eventually covered with glazed tiles. At present, owing to the length of time

brick, a good roofing tile, and a hand-pressed floor tile. I regret I cannot show you these, but the specimens of stoneware (exhibited to the Meeting) you see among these pots are, I trust, a guarantee of the goodness of the materials I cannot show you. I may mention that in the course of our experiments we have produced every known potting body, including true hard translucent porcelain.—R. F. C.

* See his *History of Indian and Eastern Architecture*, pp. 559-565. 8o. Lond. 1876. Woodcuts 317 & 319 represent the dome of the Jumma Musjid, and 322 & 323 that of the Tomb of Mahmoud, both at Beejapore.

XII. NEW COLLEGE FOR THE GAEKWAR OF BARODA, WITH NOTES ON STYLE AND DOMICAL CONSTRUCTION IN INDIA (lviii.)

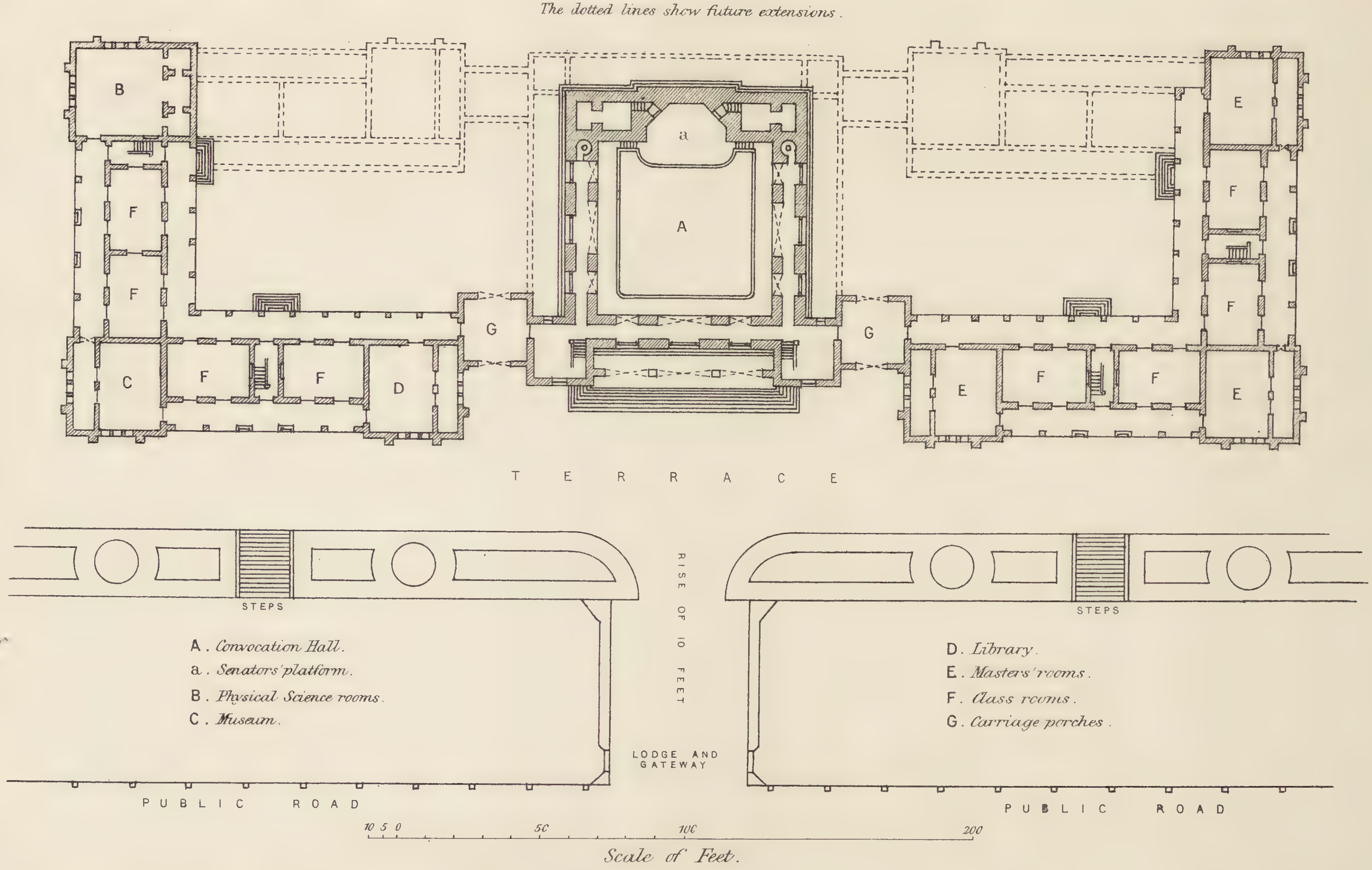
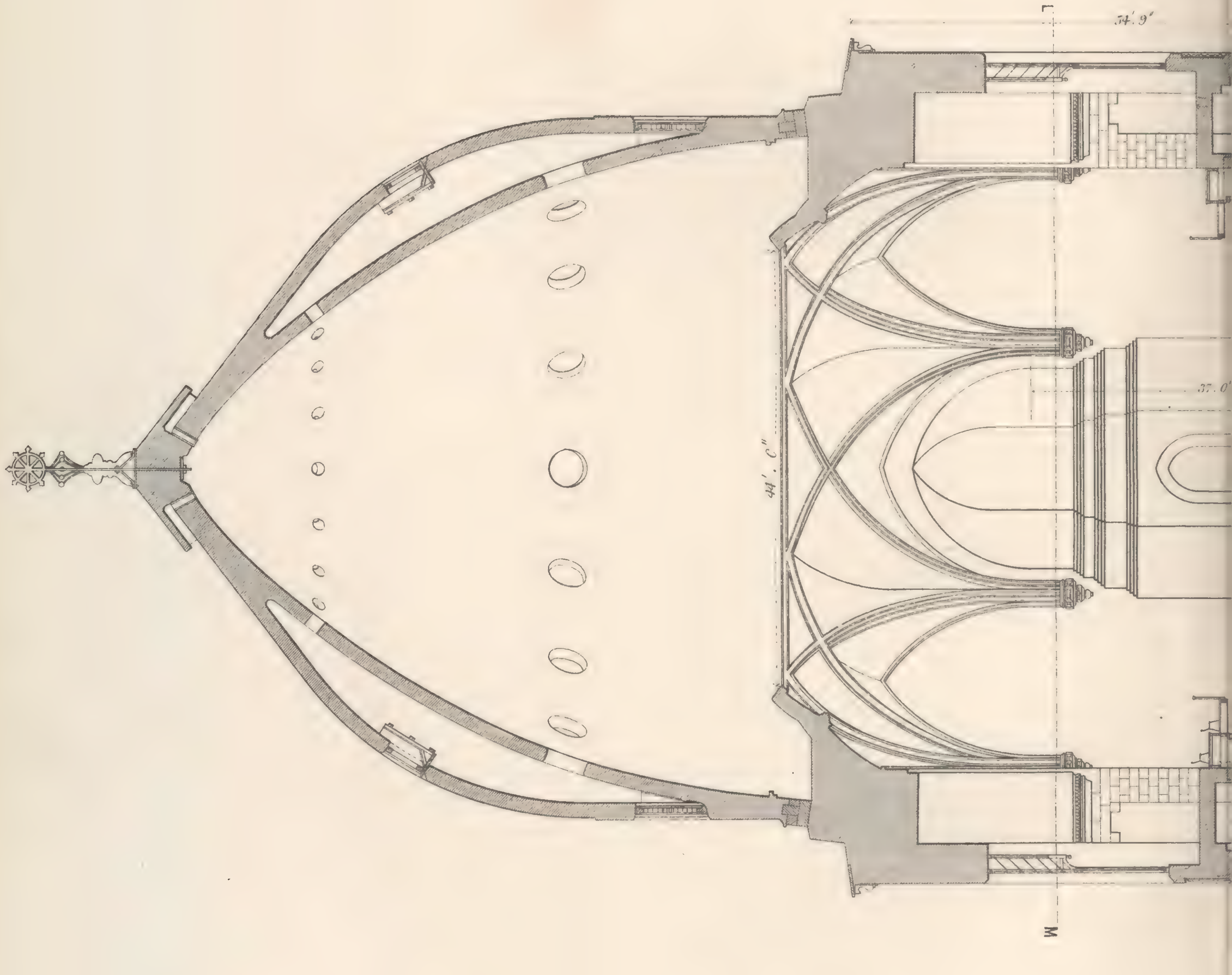


FIG. 157. GROUND FLOOR PLAN OF THE COLLEGE.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.

XII. NEW COLLEGE FOR THE GAEKWAR OF BARODA, WITH NOTES ON STYLE AND DOMICAL CONSTRUCTION IN



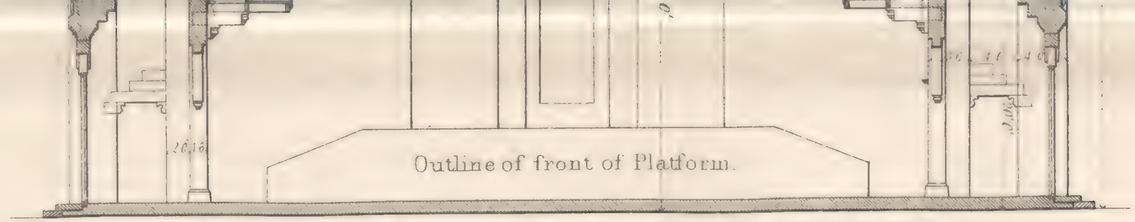
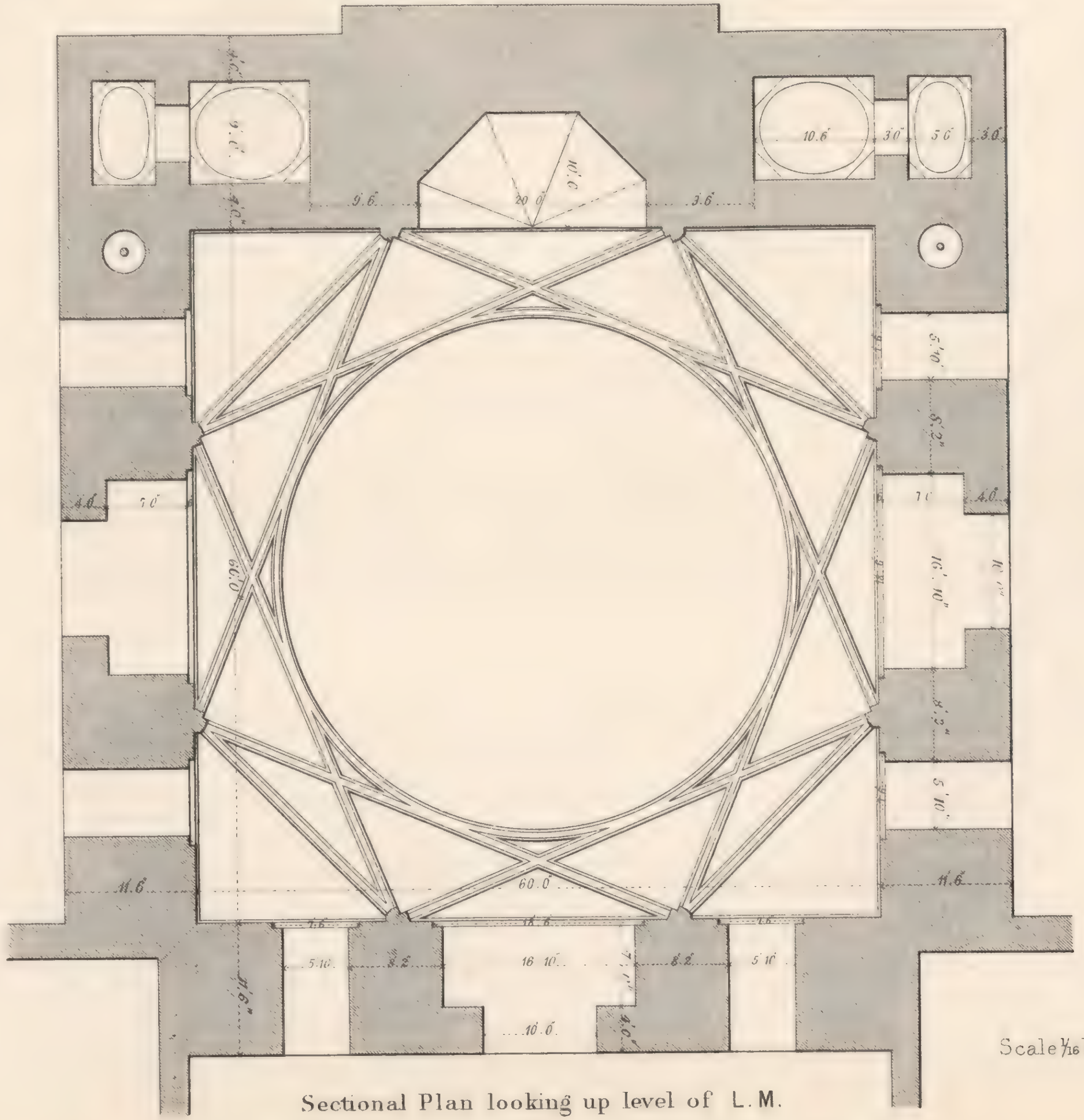


FIG. 159. SECTION SHOWING VAULTING AND THE DOME OVER.



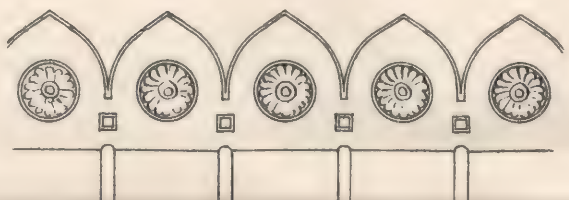
Scale 1/16 Inch = 1 Foot

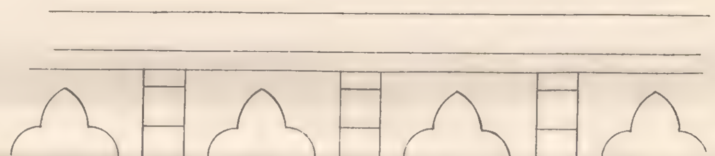
Sectional Plan looking up level of L.M.

FIG. 158, THE CONVOCATION HALL, SHOWING RIBS OF VAULTING

XII. NEW COLLEGE FOR THE GAEKWAR OF BARODA, WITH NOTES ON STYLE AND DOMICAL CONSTRUCTION IN INDIA (Ix)

FIG. 160, DETAILS OF CUT STONE BALCONIES WITH TERRA-COTTA BAS-RELIEFS.





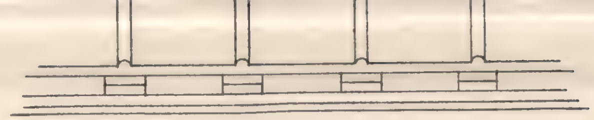


FIG. 161, CUT STONE CORNICE AND PARAPET.

FIG. 162, CORNICE CORBELLING.

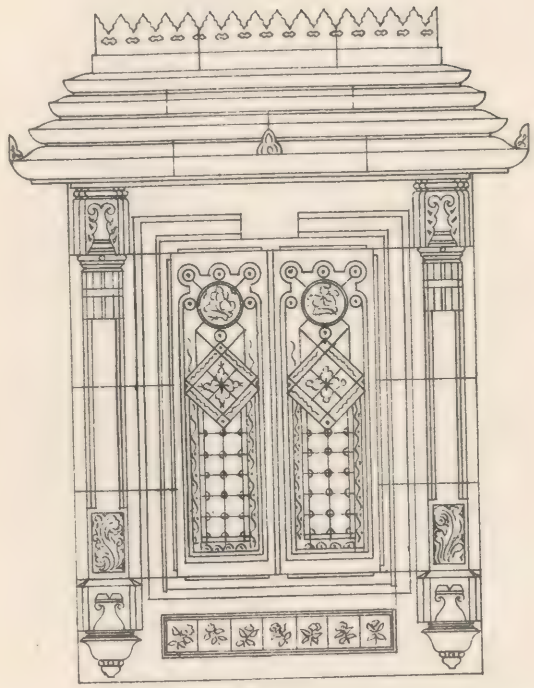


FIG. 163 LOWER WINDOW OF STAIRCASES.
(IN CUT STONE.)

FIG. 164, UPPER WINDOW OF STAIRCASES.
(TERRA-COTTA PANELS.)

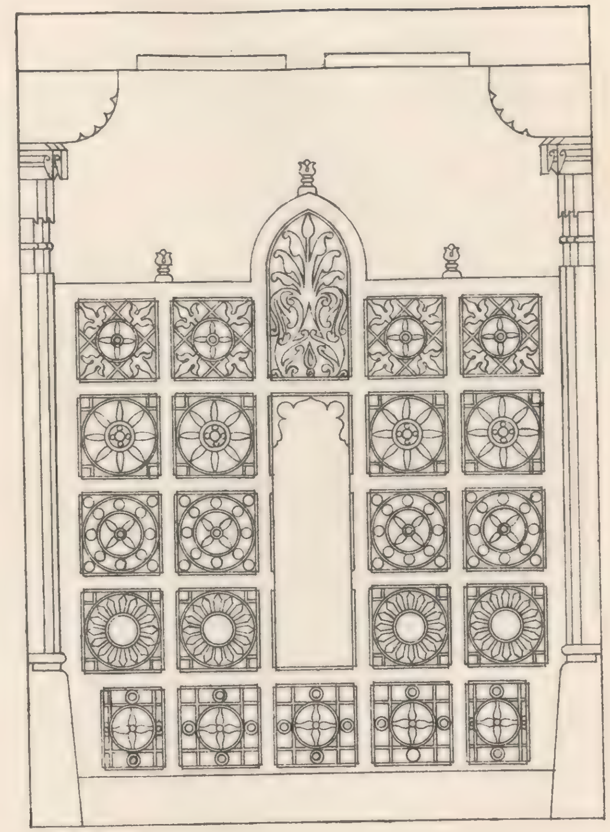


FIG. 165 JALEE WORK IN VERANDAHS.
(IN CUT STONE.)

C.F.Kell, Photo-Litho. Castle St. Holborn, London, E.C.

likely to elapse before the necessary quantity can be turned out, the domes are ornamented with coloured sgraffito in cement.

In regard to domical construction it is scarcely correct, in my judgment, to say that a dome has *no* thrust. As a matter of fact, a very considerable central mass is poised in the air, and only prevented from falling by a series of diagonal props. It is true that the calculated lines of maximum pressure may be in reality vertical, or even inwards at the base of the dome where it meets the support of the walls, but the tendency of the central mass, nevertheless, is to fall, which it endeavours to do by thrusting the supports outwards at some point variable according to circumstances, and the strain, by cohesion of parts, is transmitted throughout the structure, rupture being prevented, either by this cohesion or by counterpoising. A dome, stable in itself, by virtue of cohesion, cannot exert an outward thrust at the points of support, but the cost of material, necessary to secure these conditions, could be more advantageously employed in other forms. In brickwork, an enormous thickness would be required at the weak points in order to keep the lines of maximum pressure within the outer curve. Calculations necessary to ascertain this are unsatisfactory, because this power of cohesion cannot be adequately represented in formulæ, the results of practical experiments not being available. Wren, in St. Paul's, constructed his dome on a cone of brickwork and thus reduced all thrust to a known point, namely, the bottom of the cone. It appears to me that this contains the germ of the true scientific method of domical construction, and a consideration of this expedient gave me the idea of treating a dome as a series of inclined girders, the thrust of each of which at the base can be easily ascertained by a simple resolution of force. In the case of the Baroda dome, the downward pressure so far exceeds the outward thrust, that friction forms the tie, but in domes of less comparative altitude a tie should be provided, and herein lies the chief difficulty of domical construction on an extended scale, for the expansion and contraction of metal—the only material which possesses the adequate tensile power—renders its use dangerous after certain dimensions are reached. The expedient of a live weight, or ring of weights suspended within the dome, might easily be arranged to exert a constant strain if circumstances demanded a dome of low altitude and cheap supports. The small stone cupolas, so numerous in upper and central India, are cramped throughout, and the thrust is thus transferred to the tensile power of the cramps or the stone. The cramps are made of an exceedingly hard wood, which adds to qualities of great durability and hardness the power of retaining a constant form under varying circumstances.

I now come to a consideration of the false dome. The true external dome resting on the four supporting walls, and rendered stable, not by the cohesion of its parts, but by its inability to slip outwards on the walls, is now actually exerting a thrust which, in the absence of cohesion, would turn the four supporting walls outwards, and this thrust is counteracted by the weight of the corbelling forming the arches of the false dome. It is unnecessary to enumerate the various expedients by which the circular form within the supporting square may be arrived-at. Probably the simplest and most beautiful is the Byzantine, where the vault forms a true unbroken semicircle on the diagonal section from corner to corner. But this form, apart from the severe strain exerted during construction, demands supports and counterpoises of an elaborate and expensive character, and, until the eye is actually closed, the pendants have an alarming tendency to fall in. When a drum has to be sustained or where the curvature changes, as in

St. Mark's, arching the corners to form the octagon would be a stronger method of construction. Now, in the eastern domes, we have a clever combination of both these expedients, possessing the lightness and strength of the latter and the elegance of the former, for constructive unity is maintained throughout the visible portion of the interior. The native scaffolding, although strong and elastic is very unsightly, as all the cross-bracing is done with palmyra rafters and bamboos, but, with the exception of the four exterior angles of the lower false dome, nothing but this rough scaffolding was used during the construction of the work at Baroda.

The arches of the false dome were corbelled-out until they met, and the angles further corbelled-out to the circle. When once the circular form is reached the structure is stable, by virtue of the *jamming* of the material which cannot fall unless some part crushes. In brickwork domes of low curvature, the compression of the joints causes a slight settlement, which opens a longitudinal crack along the back during construction. I turned two domes semicircular on the diagonal without centres, springing from 5-feet square piers, 24 feet apart in the square, and both had horizontal cracks on the back. These cracks closed, however, when the dome was keyed. The true dome above the walls was commenced by laying two carefully dressed courses of stone breaking bond and cramped with gun metal. The cramping is a precautionary expedient on which I place little value, as the slightest unequal settlement would crack the stones and destroy the tie. The scaffolding was raised on the space between the eye of the false dome and the true dome. A light framework was laid across the eye, and on this a central post was raised to regulate the curvature. This was effected by means of three or four copper wires, the lower ends of which were fastened to the central pole, while the upper ends, marked according to the measured distances taken from the drawing, were held by the bricklayers. The bricks were ordinary stock moulded bricks without a frog; and the mortar was composed of kunker lime and pounded brick in the form of dust. No especial precautions were taken in the laying; only the ordinary rates, plus the extra charge for high work, being paid to the men. The work was carried-up with the joints at right angles to the tangents of the curves, and not corbelled. It progressed at the rate of about two complete courses a day, and the outer and inner rings and binding walls were raised simultaneously. I may mention that I made an experimental dome, 16 feet in diameter, constructed on the ground, of terrace bricks which measure 6 in. by 3 in. by 1 in. The outer and inner domes and binding walls were consequently only 3 inches thick. This structure has stood for the past five or six years as a tool house.

A word in conclusion. Although I advocate an earnest and honest study of native art, and a liberal use of it on buildings, palatial or monumental, I would take this opportunity of deprecating publicly, in the most emphatic manner possible, any vulgar endeavour to make buildings of utility, such as barracks, hospitals and gaols, highly ornate; let as much thought be bestowed on the design as possible, as much labour over the drawing-board as time will allow, but any attempts to redeem ugliness by useless additions to break a sky-line, or by features purely ornamental, is vulgar ostentation and a misapplication of public funds. India, like other parts of the British Empire, has suffered, and is likely to suffer still more in this way. It cannot, therefore, be too often repeated that good architecture may naturally follow honest building, though the converse will scarcely hold good.

R.F. Chisholm. del.

BARODA COLLEGE

Constructed for His Highness Syaji Rao Gaekwar.

XIII. THE TEMPLE OF DIANA AT EPHESUS, WITH ESPECIAL REFERENCE TO MR. WOOD'S DISCOVERIES OF ITS REMAINS.

By James Fergusson, C.I.E., F.R.S., D.C.L. (Oxon.), *Past Vice-President.*

[Paper communicated and ordered to be printed 11th June 1883.]

In January 1877, I read a Paper to this Institute on the "Temple of Diana at Ephesus, with especial reference to the Hypæthrum of the Greeks," which was afterwards printed in the Transactions for 1876-77, pp. 77 *et seqq.* At that time Mr. J. T. Wood had just published his popular account of the results of his excavations at Ephesus,* and I, like everybody else, was full of admiration for the wonderful sagacity which had enabled him to discover the long-forgotten site, and the patience and perseverance which had sustained him for eleven long years from the time when he first undertook the search till he had laid bare the very foundations of that celebrated temple. My principal object in bringing forward the subject at that time was not to dispute any of the *data* he had acquired during the excavations, but to add to them certain elucidations which I thought he had overlooked, and to correct what appeared to me an erroneous theory as to the mode in which light was introduced into the cella,—a subject on which I then, as now, entertained strong views, which were not those that Mr. Wood advocated.

In bringing the subject forward, I could not but regret that Mr. Wood had not then published the results of his excavations in any detailed or scientific form, nor indeed has he now, for though nine years have elapsed since they were completed, they are not yet given to the world in any shape that can be relied upon, or utilized for any scientific purpose. In this respect he would have done well to borrow a hint from the practice of our French neighbours. There is, in the École des Beaux-Arts, a beautiful series of drawings of ancient monuments, the result of investigations made by French architects in competing for the prizes offered by the different Academies. In all these drawings the first and most indispensable is a detailed plan, with an elevation of the building as it exists, adding nothing and at the same time omitting nothing that pertains to its original form. After this the architect is allowed to indulge his learning or imagination to any extent he likes; and many of the restorations are wild and fanciful to an extent that is more amusing than instructive. This, however, is of little consequence, as the materials are afforded by which a judgment can be arrived-at, by outsiders, as to their truth or falsehood, and every one can restore the building from the *data* given nearly as well as the original explorer of the remains. Mr. Wood has reversed the process. He has published a restoration, which, to say the least of it, is open to criticism, but he has not published the *data* on which it is founded, nor has he given a separate plan of the results of his excavations. We consequently never knew what he found *in situ*, or what he inferred from the remains which he actually discovered. I was in hopes that in my case this would have been remedied, as he gave me to understand, that he would lend me, for the purpose of my

* *Discoveries at Ephesus, including the site and remains of the great Temple of Diana*, by J. T. Wood, F.S.A., fo. Lond. 1877. See also Mr. Wood's Paper on "The Temple of Diana at Ephesus," in the Transactions, 1874-75, pp. 135-147.

lecture, his working-plan of the excavations, on which are marked all the requisite details. But at the last moment it was found to be stowed away among some old papers in an old chest at Hammersmith and was not accessible! He lent me, however, a plan on sufficient scale, which he had prepared for his own lectures. With that I was obliged to be content, but it did not contain all, or nearly all, the desired information.

If, when Mr. Wood returned home in 1874, he had been content to publish a plain narrative of what he had found at Ephesus, accompanied by his working-plan of the remains but without any attempt at restoration, his name would have stood among the first of British archæological explorers. The trustees of the British Museum would no doubt have borne the expense of such a publication, as it was indispensable to explain the marbles, which had already cost them some £16,000; and such a publication would have cost a hardly appreciable portion of that amount. If afterwards he felt that he was better qualified than anyone else to breathe life into the "disjecta membra" of the temple, the public would have listened with pleasure to what the discoverer of the temple had to say on the subject, though it by no means follows, as a general rule, that those most fitted to dig are the best qualified to draw; but there is no reason why the attempt should not be made. But in the present instance, as I fancy it will appear in the sequel, the attempt has not proved successful, if for no other reason, at least this: that the temple at Ephesus, according to his restoration, instead of being the largest and most magnificent temple — the wonder of the ancient world — turns out to be smaller, and in most essential respects an inferior temple to that at Didyme, existing in its immediate neighbourhood.

There is not a shadow of a reason for suspecting that, in thus reversing the ordinary course of proceeding, Mr. Wood intended to mislead anyone, or to slur over any inconvenient fact. It is understood that his only motive in acting in this manner, and his refusing to let even the trustees of the British Museum have a copy of his plan, is that he hopes one day to publish a great book on the temple, and he naturally wishes to reserve his plan and all the more important details for his own folio work. Throughout he has been transparently honest, and all his figured dimensions are accurate to inches, or half inches, as the case may be; but the misfortune is, from the scale on which they are published, those which are not figured can hardly ever be ascertained with accuracy, and from the paucity of details in the text it never can be ascertained whether they were measured or merely inferred. In the plan, for instance, the distances between the bases of the columns and the topmost step is about 15 feet at the sides, at the ends it is about 17 feet or 18 feet; in neither instance is the figure quoted. In the sections it is 17 feet at the sides and 18 feet at the ends, as nearly as can be measured from the scales. But a more important point is: On the plan the distance from the centre of the inner pillars of the pronaos to the centre of the wall of the vestibule is 29 feet at least. In the posticum it is 30 or 31 feet. Neither of these dimensions is admissible, if we remember the story told by Pliny of how the architect despaired of ever being able to raise an epistylium, which we now know was only 28 feet 8½ inches.* I got over the difficulty by bringing forward the wall of the pronaos (which I was perfectly justified in doing by Mr. Wood's *not* finding it), and putting the stairs behind the wall of the posticum. According to Mr. Wood's plan, it could only be remedied by adding two pillars to the pronaos and two to the posticum.

* Pliny, book XXXVI. ch. 14.

It is true the inner epistylium would then only have been 15 feet instead of 17 feet, which is that of the peristyle, but that would have been better than the impossible one of 30 feet; it would have involved, however, the introduction of four more pillars to the plan, which would have been fatal to the theory of introducing a comma after "centum," and therefore Mr. Wood considered he was justified in rejecting the idea and facing the difficulty by introducing the 30 feet epistylia. In the sections * the length is reduced to 27 feet and 28 feet, but this is only another instance of the danger of working on so small a scale. These differences are not perceived either by their author or the student who examines the drawings, but they are frequently of the utmost importance in working-out the details for the restoration of the temple.

These were blemishes of course, and made Mr. Wood's restoration in some respects very unsatisfactory, but there was nothing in them that might not have been put right by better drawings on a larger scale and more pains on his part. But there was one thing came out in these investigations which appeared to me then, as now, quite unaccountable, which no improvement in the drawings could explain away: It was that the temple of Apollo at Didyme, as restored by the Society of Dilettanti,† and now excavated by Messrs. Rayet and Thomas,‡ was a larger and finer temple in every essential respect than that of Ephesus as restored by Mr. Wood. It had 120 columns of the Ionic order nearly 65 feet high, against 100 columns 60 feet in height—Mr. Wood makes them only 55 feet $8\frac{3}{4}$ inches—at Ephesus. It was the same width as Ephesus, but 13 feet more in length. Against this Ephesus could only adduce its "36 columnæ cælatæ," but the value of even this exceptional adornment was diminished by the richly carved bases of the 10 front columns at Didyme. The pyramid of 14 steps on which Mr. Wood found the Ephesian temple had been raised was also an exceptional feature; as he, however, restored them, they were rather an architectural deformity than an ornament. They hid the bases of the columns—even those that were "cælatæ"—from the courtyard and prevented the pillars in all instances from having a proper base or apparent foundation. No such solecism is to be found in any temple in the ancient world. Notwithstanding all this, no author among the ancients speaks of the Temple of Ephesus without going into raptures about its beauty and magnificence. Philo says: "It is the only house of the gods. "Whoever examines it would believe that the gods had left their immortal regions to come "down and live on earth."§ Pliny, after lauding the tomb of Porsenna and the hanging garden of Babylon (misprinted Thebes), says: "But though these are wonderful, the temple "of the Ephesian Diana is a work of truly admirable magnificence."|| Pausanias, in his fourth book, speaks of the magnitude of the Ephesian temple, which surpasses every other structure raised by human hands;¶ and, in his seventh book, states "that it excelled all others in "magnitude and splendour, while next to it came the temple of Apollo at Branchidæ."** Numerous other voices are raised to extol it, and all are agreed that it was worthy to be ranked as one of the seven wonders of the world. But while this is so, there is great difficulty in finding any author (except Pausanias) who mentions the temple at Didyme, and not one who

* There are no numbers to the plans of Mr. Wood's work, and they are not opposite any particular pages, so that there is great difficulty in referring to them correctly.—J. F.

† *Antiquities of Iona*, vol. I, ch. 3, plate 3, *et seqq.*

‡ *Gazette des Beaux-Arts.* July, 1876.

§ Philo de septem miraculis mundi.

|| Pliny, XXXIV. 13, 14.

¶ Pausanias, IV. 31.

** Pausanias, VII. 5.

goes into raptures about it, as hundreds do over the Ephesian temple.* In short, it turned out that the temple of Diana at Ephesus, as restored by Mr. Wood, was much smaller and in almost every essential respect an inferior temple to that of Apollo at Branchidæ, in direct contradiction to the testimony of Pausanias and the generally expressed opinion of the whole ancient world.

When I wrote my previous Paper on this subject, the only mode that occurred to me of reconciling this universal testimony of the ancients with the very commonplace temple represented in Mr. Wood's work, was to assume that all this glorification was due to the exceptional magnificence of its podium. It seemed easy to understand how a mass of marble masonry, 425 feet in length, 220 feet in breadth, and 10 feet high, if covered with bas-reliefs, on its four faces, and crowned by a crowd of statues in marble and bronze, mingled with architectural ornaments, might easily, in the hands of Greek architects, become an object of surpassing beauty, and worthy of all the praise that was bestowed upon it. The recent discovery of the great altar at Pergamos, the sculptures of which are now the principal ornaments of the Berlin Museum, was sufficient to show how nearly I might have been right in this assumption. At an earlier and a better age this stylobate must indeed have been a thing of beauty, such as even the ancient world could hardly parallel, and now that it can be shown that it was surmounted by a peristyle consisting of a larger number of columns than any known example, and nearly a third of them adorned with sculpture of exceptional beauty, we have no difficulty in understanding the raptures the ancients fell into in speaking of the surpassing beauty and magnificence of this far-famed temple.

All these considerations made out a case against Mr. Wood's plan and proposals that showed them to be unsatisfactory and perplexing in the extreme, but was hardly sufficient to justify anyone in rejecting them as altogether mistaken. The errors in drawing and design might have been remedied by a more careful protraction on a larger scale, and further study of the architectural necessities of the temple. I had not, of course, a moment's hesitation in rejecting his mode of lighting the cella by taking off the roof of it entirely, while carefully covering over the vestibules and porticoes at either end of it. In this it was evident that he was merely following the practice of what is now, it is to be hoped, an extinct school of architects, and did not pretend that he was thinking for himself, or had found anything at Ephesus to justify this mode of restoring the temple. But while he had spent so many years in exploring the remains it would have been a strong measure to reject his plan of it, without at least having something to substitute for it. This I was not prepared to do when I submitted my proposals for the emendation of Mr. Wood's plan to the Institute. When, therefore, I came to that part of my book on the Parthenon in which it was necessary I should say a few words on the mode in which light was introduced into the Ephesian, as one of the four great hypæthral temples of the ancient world, I could only repeat what I had before said, without any essential variation. When, however, I saw in type what I had written, and took down Pliny to verify the references, I felt convinced there must be a great mistake somewhere; and after several attempts to reconcile the ancient with the modern restorers of the fane, it occurred to me that there must have been nine columns in the posticum, with the ordinary epistylia to match the unusually widely-

* In my former Paper (TRANSACTIONS, 1876-77, pp. 81 & 89) I gave plans of these two temples, as a means of comparing them, though unfortunately not to the same scale.—J. F.

spaced eight in the pronaos. We had then only to assume that there were three rows of columns in the rear and to add one row to the front, to which there was no objection, and all the difficulties with regard to the plan of the temple were solved. There were 127 columns, and it was the greatest and most ornate temple of the ancient world.

As the temple at Ephesus formed only an episode in my work on the Parthenon,* and one not bearing directly on the main argument of the work, I did not think it worth while to stop the printing of the work for the sake of this discovery. I thought it would be sufficient to insert a diagram to explain its nature, which was done at p. 34, and reserved myself the right to work it out more in detail on some future occasion. It would have required more thought and more time than I could then afford to bestow on it, to do this properly, but that is what I now propose. I hope, in the present Paper, to explain what the plan of this far-famed temple really was, and the causes which led to its being of such exceptional magnificence.

Notwithstanding the apparent failure on Mr. Wood's part to appreciate the true significance of his own discoveries, his excavations brought to light a mass of authentic facts which alone have sufficed to render the history of the temple intelligible and its restoration possible. Before his time all was mere guess-work, founded on not very intelligible written texts: these have now become clear and certain, and we may proceed to restore its forms and features with certainty and success.

From various historical indications we learn that there existed at Ephesus seven or eight successive temples dedicated to Diana, all of which except the last were destroyed by fire. With the first five of these we have nothing to do at present, no trace of them has been found in the excavations, and it is even uncertain if they stood on the same spot. From the anecdote told by Herodotus † of the Ephesians joining the city to the temple by a string or tape (?) seven stadia in length when attacked by Crœsus, I would fancy the original temples stood on the rocky summit of Aiasluk, at the distance of seven stadia from the city, but being subject to earthquakes in that situation, the temple was afterwards moved down to the alluvial plain. The last three were certainly situated on the same spot, and built, as Mr. Wood found them, one over the other, and approximately at least on the same plan. It is consequently with these three that we are now concerned, and to them and them only the following remarks will be confined.

So essentially were the three considered as one temple, that it is almost certain that to them the remark of Pliny applies, that "it was erected at the expense of all Asia in the "period of two hundred and twenty years."‡ If we knew exactly when this period commenced, the history of the three temples with which we are now concerned would be easy. Generally it is supposed from the names of the architects that it was about 600 B.C., but the assertion of Herodotus§ cannot be overlooked where he says that "several of the pillars were presented by "Crœsus"; and as this could only apply to a new temple, then undertaken, it seems to indicate it was during his lifetime that it was commenced. It must consequently have been before 546 B.C., when he was conquered by Cyrus. If we assume 550 B.C. as the date of its commencement,

* *The Parthenon; an Essay on the mode by which light was introduced into Greek and Roman Temples*, pp. 32-38. 4o. Lond. 1883.

† Herodotus, I. 26. ‡ Pliny, XXXVI. 14. § Herodotus, I. 92.

it takes us down to 330 B.C. as the date of the completion of the last—three years after Alexander's visit, and twenty-six years after the penultimate temple was burnt by Herostratus. Another circumstance that renders the date probable is that Pliny when speaking of the durability of the timber of its roof says that it had lasted 400 years.* As his book was probably written about the year 70 A.D.—he died in 79—this would take us back to exactly 330 B.C. for the roof—the last part—being put on the temple. Of course it may be asserted that Pliny is speaking in round numbers, and this may not be the exact date, but with so accurate an author as Pliny is generally found to be, when properly interpreted, it may safely be inferred that he considered the date of the completion of the last temple was not far from that date. The one question is, is twenty-six years sufficient for the erection of such a temple as we know this to have been? It does not appear that a longer interval was required. The Parthenon, according to the longest calculation,† was erected in sixteen years by the smaller and less wealthy community of Athens, and generally it is supposed it was finished in eight years. Our St. Paul's Cathedral, which is a far larger and more complicated building, was erected in thirty-five years; and altogether I see no improbability in the Ephesian temple being restored in twenty-six years. It must have been tolerably near completion when the Ephesians rejected Alexander's offer to repay the cost, and they must have felt confidence in their being able to complete it.

Whether this is the exact date of the beginning of the first and the finishing of the last of these three temples, their history is otherwise tolerably well known. The first was begun by Chersiphron, aided by his son Metagenes, either in the year 550 B.C. or shortly afterwards. It was destroyed by fire about the year 400 B.C., in the same year, according to Eusebius, that Socrates drank poison.‡ It was rebuilt and restored by Païonius, the same architect who built its rival and almost duplicate at Didyme. This temple was the one that was burnt by Herostratus in the same year that Alexander was born, and is the temple to which all that is said by Pliny, and all that was found by Mr. Wood, exclusively applies. The third temple we are told by Strabo § was built by an architect indifferently called Cheiromocrates or Deinocrates, who was largely patronized by Alexander the Great, and laid out the City of Alexandria under his direction. We are told also that he proposed to cut Mount Athos into a likeness of his patron, and it is probably to him that the temple at Ephesus owes some at least of the novelties which made it afterwards so famous.

Being so similar to one another, the first suggestion that occurs to any one is that they were not destroyed, but merely damaged by these successive fires, and afterwards easily restored. It seems it must have been a difficult operation to set fire to a Greek peristylar temple, for though the central roof was of wood and of considerable extent, the lacunaria of the peristyles, even if of wood, were so small in extent that even if they took fire from the conflagration of the central roof their burning would hardly be sufficient to affect the pillars that supported them. All, therefore, one would naturally suppose would be required after each of these fires would be a thorough repair of the existing building. One, however, of the most curious, and for the history of the temple most important, of Mr. Wood's discoveries disposes at once of this suggestion. He found that the original temple of Chersiphron was

* Hist. Nat. XVI. 40.

† A. Michælis, Parthenon, p. 9.

‡ Eusebius, Pamph. Chron. Can. I. 134.

§ Strabo XIV. p. 641.

raised only 2 feet above the level of the court yard, on a podium of three steps each 8 inches in height. Of the intermediate temple built by Païonius, Mr. Wood says, "Nearly 4 feet above the "lowest of these three pavements (that of Chersiphron) was found the highly-polished white "marble pavement of the last temple but one (that burnt by Herostratus). Large patches "remained in position, and were only discovered on the removal of the foundation piers of the "church." * The platform on which the pillars of the third and last temple stood was raised 3 feet 6 inches above this, and so stood 9 feet 5½ inches above the pavement of the court outside, and 7 feet 5 inches above the platform of those of the first temple. These relative heights are shown in the section A. B. [Illustn. lxii. fig. 168.]

It is evident that, even if used again, the pillars must have been taken down and rebuilt on a higher level each time, for we know of no process by which a pillar 6 feet in diameter and 60 feet in height could be elevated 3 or 4 feet above where it stood before. However unlikely therefore it may appear, we must assume that at each burning the temple was so damaged by fire that it practically had to be rebuilt, and that what we now find there is in reality the temple of Deinocrates and that only.

Whether the arrangement of the columns was the same in the three temples is not known; probably it was, and that the number was 118. The third row in the posticum was almost certainly added afterwards, but the podium in the three was certainly different, and if I am not mistaken, this, which Pliny calls the "universum templum," and was its greatest beauty, was absent from the earlier two. The first because it was raised only three steps or 2 feet could have no such ornamental base. The second was only raised six steps or 4 feet higher, which scarcely admitted of much architectural adornment; but the third, with a podium of nearly 10 feet, could be ornamented to almost any extent, and so far as I can see formed the most characteristic and the great distinguishing feature of this far-famed temple.

As nearly all that was known about the temple was contained in a short paragraph in the thirty-sixth book of Pliny's *Natural History*, it may be as well to quote it entirely, as every word is of importance. After speaking of the tomb of Porsenna and the hanging gardens of Thebes (Babylon ?), he continues, "But the temple of the Ephesian Diana is a work of truly "admirable magnificence, which was raised at the joint expense of all Asia, and occupied two "hundred and twenty years in building. It was placed on a marsh, in order that it should not "be endangered by earthquakes or cleavings of the ground. Besides, that the foundation of "such a pile might not be laid on a sliding or unsuitable foundation, they laid a bed of "charcoal, over which they placed fleeces of wool. The total length of the temple is 425 feet, "its width 220 feet. (It has) one hundred and twenty-seven columns, each the gift of a king, "and 60 feet in height. Of these thirty-six are ornamented by carving, one of which is by "Scopas. Chersiphron was the architect who directed the works." †

The above account has every appearance of exactness and authenticity, even though, as it is not the habit in classical books to quote authorities, we are at a loss to ascertain whence the

* See *Discoveries at Ephesus*, page 262.

† Magnificenciæ vero admiratio exstat templum Ephesiæ Dianæ ducentis viginti annis factum a tota Asiæ. In solo id Palustri facere ne terræ motus sentiret aut hiatus timeret. Rurus ne in lubrico atque instabili fundamenta tantæ molis locarentur, calcatis ea substravere carbonibus dein velleribus lanæ. Universo templo longitudo est CCCCXXV pedum latitudo ducentorum viginti, columnæ centum viginti septem a singulis regibus

information was derived which it contains. It is not supposed that Pliny ever visited Ephesus, or saw its temple, and the details of his account are too minute to be derived from mere hearsay. We learn from Vitruvius that Chersiphron, with his son Metagenes, wrote a description of the building they had been employed to superintend,* but it could hardly be from that work that Pliny was quoting, as it described necessarily the first of the three temples erected on this spot, and there are many reasons for supposing that the third, which existed in Pliny's time, differed in some essential respects from that of Chersiphron. It is more probable that he was quoting from the book of Democritus, an Ephesian, who, we learn from Diogenes Laertius † and Athenæus,‡ wrote a book about the temple at Ephesus, but which is now lost, except one paragraph about the luxury of its priests, but of no use for the description of the temple. It is probable, however, that it may have contained the information Pliny retailed. Democritus certainly lived at Ephesus, and at a time when the temple was in its greatest state of completeness.

The most important statement in the above description for the restoration of the temple, from whatever source it was derived, is the number of the columns, namely 127, which has hitherto proved a stumbling block to all commentators. Some have been puzzled by the odd number of the columns, which they assert is impossible in a regular Greek temple, and consequently propose to add or substract a I from CXXVII, but as the number is expressed in words no correction of the text in this manner is possible. Others consider the number greater than could be employed. At Athens and Didyme the number was only 120, and it is difficult to see how a greater number could be arranged round any cella. Mr. Falkener consequently proposed to insert a comma after 120, making that the number employed, of which consequently it followed that seven only were given by different kings.§ Mr. Wood went further than this, and inserted a comma after 100, making twenty-seven the gift of the kings, which, if the text must be tampered-with, seems on the whole the more probable division. || But as no commas are used in Latin books, all scholars are agreed that this mode of dividing a sentence into two parts is quite inadmissible. The solution of the difficulty lies I am convinced in a study of his own plan, coupled with a paragraph with which Pliny concludes his description. "The frontispiece in particular offered enormous difficulties, in "consequence of the immense size (of the epistylium). This mass, the heaviest of all, could "not be settled evenly on its bed, and the artist in despair (of effecting this) determined on "suicide. A prey to these thoughts he fell asleep through fatigue, when the goddess for "whom the building was being erected appeared to him in a dream and encouraged him "to live, and saying that she herself had placed the stone. The following day it was found "that the stone had sunk into its proper place by its own weight." ¶

This could not apply to the lintel of the great doorway, which a literal translation of the text might lead some to infer, as Mr. Wood found "near the west wall of the cella two large "marble blocks resting on a massive and solid foundation, in which was cut the groove for the "outer bronze wheel, on which the door of the temple moved. . . . The mortice for the door

factæ LX pedum altitudine, ex iis XXXVI cælatæ una a Scopa. Operi præfuit Chersiphron Architectus.—*Hist. Nat.* XXXVI. chap. 14.—J. F.

* Vitruvius' Præf. VII. † Diogenes Laert. IX. 49. ‡ Athenæus, XII. p. 525.

§ Falkener's *Ephesus*, p. 241. || Wood's *Discoveries*, p. 265. ¶ Pliny, *loc. cit.*

"frame was also cut in one of these stones. The exact width of the whole door was thus "ascertained to be 14 feet 8½ inches, in two parts, as folding doors."* This it is true was of the middle temple, that of Païonius, but as it is exactly the proportion that would suit a temple of the given dimensions, there is no reason for supposing that the doorway of the first and third differed from it to an extent of about a foot, more or less, and if so a lintel of 16 feet or 17 feet would have been no difficulty in a temple where the shortest epistylium † was more than 17 feet, and it would be infinitely more difficult to place these on pillars 60 feet in height, than to place such a lintel on a solid wall, at a height not exceeding 35 feet or 36 feet.

A very cursory study, however, of Mr. Wood's plan is sufficient to make the crux apparent. According to it the central epistylium was 28 feet 8½ inches, the next 23 feet 6 inches; the third 20 feet 4½ inches, and the outside one 19 feet 4 inches. He has not yet explained how he arrived at such minute exactness, but it is easy to see that the position of the antæ and the dipteral ranges of the peristyle must have involved some such graduated spacing, and he is so exact a surveyor that there seems no reason for doubting its entire correctness.

A similar arrangement occurs at Sardis in the temple of Cybele, where the central epistylium is 25 feet 4½ inches, the next 21 feet 7½ inches, and the third 17 feet 8½ inches; the whole width being however only 143 feet 4 inches ‡ as compared with the 163 feet 9 inches at Ephesus, where the wide spacing was carried to an extent that became a *tour de force*, which may well have called for the intervention of the goddess.

If the portico at the west front of the temple had consisted of a single row of columns only, or even if it had been dipteral, this wide spacing of the pillars would have been such a mistake in design, and productive of such feebleness and disproportion, that we cannot conceive any architect of the great age perpetrating such a solecism in design. As drawn in geometric elevation, as for instance in Mr. Wood's plate of this front, it is worse and more inartistic than any design ever executed anywhere by the Greeks. By drawing the pillars to their real height of 60 Greek feet, instead of 55 which he adopts, the proportion is improved, but this is only a slight palliation, the radical defect remains. The truth is, such a portico as that at Ephesus is never in reality seen, as drawn in simple elevation; even when looked-at exactly in front, the columns immediately in rear come into view, and when seen from ever so little on either side, the rear columns support those in front to such an extent, that the transverse epistylium loses almost all its importance. In that position the attention is fixed on the epistylia of the range of five columns, of which that in front is only the termination, and it is supported by their epistylia, in its rear, which in effect become more important to the design than those connecting the columns of the front. The consequences of this disposition of the pillars is, that, when seen at even the slightest angle from the front the resulting effect is that of more closely-spaced columns in the pronaos than exist in the peristyles; and all appearance of weakness arising from the great length of the epistylia in front is entirely obviated.

* Wood's *Discoveries*, p. 263.

† Throughout tais Paper *epistylium* is used as expressing the distance between two columns as measured from centre to centre, that being the length of the architrave that joins them. "Intercolumniation," which is too frequently employed for this purpose, only expresses the distance between the shafts at their lower diameter.—J. F.

‡ Cockerell in Leake's *Tour in Asia Minor*—Appendix.

If I am correct in my assumption, that the twelve central pillars of the pronaos were adorned with sculpture in two tiers in height, it at once becomes evident why this wide spacing became an essential necessity of the design. It was of vital importance that the five columns on either hand should be separated by as wide an avenue as possible, in order that they should be properly seen by the spectators, as well as that they should produce their proper architectural effect. The wing walls of the pronaos, probably, were also highly ornamented, possibly in sculpture, though more probably by painting, but in order that they might be properly seen as well as the reverse side of the central ranges of columns, it was in the highest degree desirable that the greatest possible unencumbered space should be made available in the pronaos, and as arches were not admissible in front, this could only be effected by lengthening the front epistylia to the greatest extent they could bear with safety.

The treatment of the pronaos at Didyme is in curious contrast with this.* The temple is of exactly the same dimension in front, 163 feet, and there are the same five columns in depth in the pronaos; but there the architect adopted the decastyle arrangement for the front, and put twenty columns into the pronaos, where there were only ten at Ephesus; but as none of the columns at Didyme were sculptured above their bases, he adopted the same spacing for them as for all the 120 columns of the temple. It would, indeed, be difficult to obtain a more convincing proof of the correctness of the views I am advocating than this different treatment in the plans of two sister temples: in one of which the pillars had no sculpture above their bases, and in the other nearly one-third were so adorned. By the treatment he adopted, Païonius may have produced at Didyme what was mechanically a finer building, but wanting in all the poetry and artistic effect of the Ephesian temple.

Whether the pillars of the pronaos at Sardis are sculptured or not, cannot be ascertained till some one digs down to their bases which are at present hidden by an accumulation of rubbish. Analogy derived from the experience gained at Ephesus and Didyme would certainly lead to the conclusion that they were more ornamental than is usual.

Although, therefore, the Ephesians adopted this wide spacing with all its inherent difficulties for the front of their temple, it by no means followed that they were to repeat it in the rear, for there is perhaps no temple anywhere which has so markedly a front and a back. The front towards the west face looks to the city and the port; the back, or east front, is looked down upon and partially hidden by the hill on which the modern village of Aisaluk stands, and could not be seen from any public place or road. The temple stood on the very edge of the alluvial plain ("loco palustri"). From the portico behind it, the hill rose with a slope of about 1 in 12 till it reached an elevation of between 60 and 70 feet at about 800 or 900 feet from the temple steps.† It seemed, therefore, the most natural thing in the world to treat this as the back of the temple, not requiring the same elaborate treatment as the front facing the city, and by introducing another column in the centre, to get over the whole difficulty. To adopt the decastyle arrangement there would have been too violent a contrast with the octastyle of the front. By adopting nine columns they could use the 19 feet 4 inches epistylia, which was evidently the one they most admired, as it is found at all the four angles, where in dignity it surpasses the

* See a plan of the temple at Didyme in the TRANSACTIONS, 1876-77, page 89.

† This fact is derived from a section of the hill obligingly made for me by Mr. Wood.—J. F.

17 feet $1\frac{1}{2}$ inches of the flanks. Thus eight epistylia at 19 feet 4 inches are equal to 154 feet 8 inches, add the thickness of one base, 8 feet 8 inches, and we have 163 feet 4 inches, which is within an inch or so of what Mr. Wood found appropriated to the eight at the other end. It is true ten pillars at 17 feet $1\frac{1}{2}$ inches would have occupied exactly the same space, and all that can be said is, that they did not, for some good reason, adopt it, but preferred the central column and uneven number.

The introduction of a central pillar is by no means an unusual feature in Greek architecture. There is an enneastyle temple at Pœstum, and the great temple at Agrigentum has seven pillars on each face. Wherever the ridge of the roof was supported by a range of internal columns, as was, for instance, the case with the so-called Incantada at Salonica,* a central pillar externally was almost indispensable, and in this instance where there was no central entrance to the posticum, but two entrances, as at Aizani and Agrigentum, the introduction of a central pillar seems to have been the most appropriate mode of treating this façade. At all events, as will appear from the sequel, it was the mode that was adopted by those who must have been better judges of the effect than we can pretend to be.

Another peculiarity of the temple, which is almost as remarkable as the wide spacing of the front, is the adoption of three rows of columns in the posticum, which is not found in any other temple we are acquainted-with. That there were three is certain, as without them it seems impossible to make up the tale of 127; but with that assumption we may leave them at present, as we shall be better able to explain their presence when we have determined the other features of the plan.

What Mr. Wood really found at Ephesus, and what he was enabled to fix with certainty, was, in the first place, the width of the cella. The foundations of its walls existed in some places, and in others there were marks on the piers which had been prepared for the Christian church, which left no doubt on the point. Its width was 69 feet $7\frac{1}{2}$ inches (70 Greek feet, above the floor ?). He found also two transverse walls, one about 120 feet from the antæ of the pronaos, and the other at a distance from it of about 152 feet (150 Greek feet ?) at the eastern end; but though the piers of the church were carefully examined on both sides, no trace of an intermediate transverse wall was found. He also found one pillar of the inner peristyle on the northern side, and one of the outer range on the southern side, absolutely *in situ;* and, as before mentioned, one of the western antæ. These are marked on his plan, a reduction of which is given on the next page. But the most important discovery he made for the restoration of the temple, though it is not marked on any plan he has published, was that he found, on the north side, about 100 feet of the lowest step of the podium—or pyramid on which the temple was raised—in broken fragments it is true, but undoubtedly *in situ,* at a distance which proved the whole width to have been 239 feet $4\frac{1}{2}$ inches; and one fragment of about 6 feet in length, at about 110 feet from the eastern cella wall, of which more hereafter.

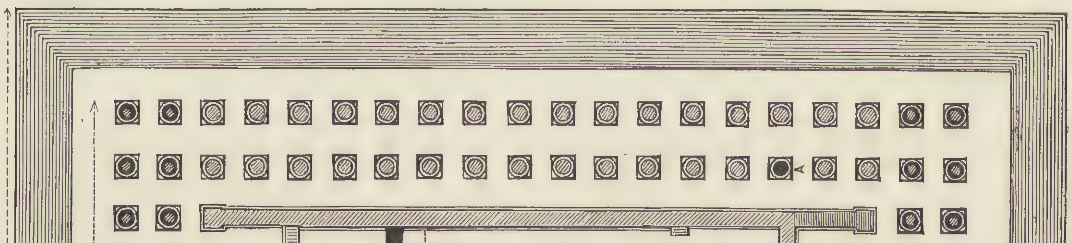
With these elements, which he seems to have ascertained with admirable precision, he was able to construct without any hesitation the plan of a temple which had, at least, 100 columns, and was raised on a podium of 14 steps, measuring about 8 inches each in height, or 9 feet $5\frac{1}{2}$ inches altogether above the level of the external pavement.

* Stuart's *Athens*, vol. III, ch. IX, p. 53.

So far as these facts justify it, there is not a word to say against Mr. Wood's plan ; but the mistake running through all he has done and written lies in the assumption that what he found was sufficient for the restoration of the temple. If, consequently, he looked into Pliny and the other authors who had written on the subject, it was only to discover that they were all wrong wherever they differed from him. It never seems to have occurred to him that those who wrote about it, when the temple was standing and perfect, must have been in a better position to describe it, than he was who found only the few " disjecta membra " which time and the barbarians have spared to the present day. Had he only bestowed half the pains to the study of the ancient writers which he devoted in digging-up the remains of the temple, he would not have fallen into the mistake, for when properly investigated there seems no difficulty in reconciling the ancient accounts, in all essential respects, with the modern discoveries, the result being a temple far more worthy of its ancient reputation than that of which he has published a plan in his *Discoveries at Ephesus.**

One of the most distinct assertions in Pliny is that " the temple was 220 feet in breadth." As this is written in words " ducentorum viginti," there can be no mistake, as is so often assumed when any measurement is only in figures. It must also, however, be assumed that Greek feet are meant. All the original authors who wrote about the temple were Greeks and wrote in that language, and the inference is that when Pliny copied their statements, he did not turn them into Roman feet—he probably hardly knew the distinction—and in all instances, especially in reference to this temple, we must be careful to turn the dimensions which Mr. Wood always expresses in English feet, into the corresponding value in Greek feet, estimated at 100 Greek feet equal to 101.35 feet English.

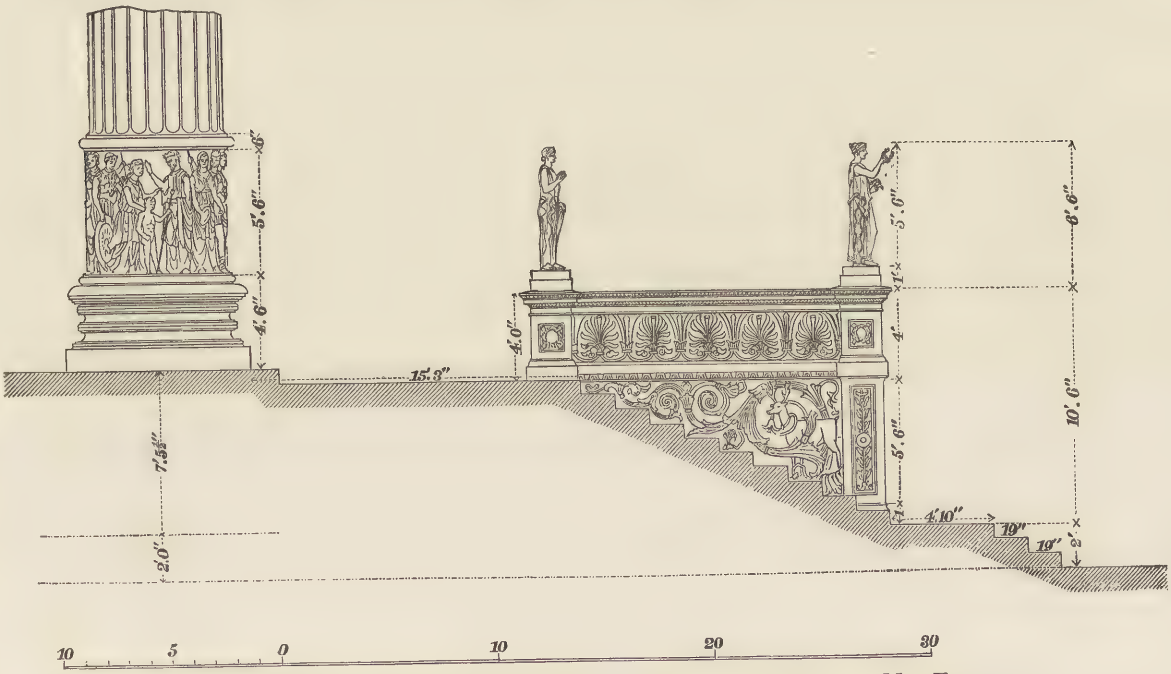
* The plan of the Temple as restored by Mr. Wood is here given with his permission. It has been



reduced from the illustration at p. 262 of his *Discoveries.* The columns marked A and B and the walling and anta coloured black were found in position. The columnæ celatæ are distinguished by a dark line inside.

This measurement was therefore (disregarding inches) 223 feet English, as shown in Illustn. lxii. fig. 167, which neither accords with the width of the peristyle, which is the ordinary modulus for a classical temple, as that was ascertained to be 163 feet 9 inches, nor does it fit the lowest step of the podium, as that measures 239 feet 4 inches, and must therefore apply to what Pliny calls the "universum templum," which, it is easy to see, could not be made many inches more or less, and may have been—probably was—exactly 220 Greek feet in width.

If the "universum templum" was represented by a perpendicular wall of 5 feet 6 inches in height—as shown in the section through the outer portion of the podium—it could not have been built on one of Mr. Wood's plain steps; there must have been an offset or berm in front of it, as shown in the woodcut. It almost certainly was raised three steps, or to the level of the original temple of Chersiphron, and consequently allowing two of these steps to measure 19 inches each, there remain 4 feet 10 inches or 5 feet for the upper step or berm, and the stylobate remains exactly 223 English feet. Adding 16 feet, or 8 feet on each side,



SECTION THROUGH THE OUTER PORTION OF THE PODIUM AS RESTORED BY MR. FERGUSSON.

it gives Mr. Wood's measurement of 239 feet English for the distance between the two lower steps the position of which he ascertained.

There was nothing found, at least nothing is mentioned in Mr. Wood's book, to show whether this measurement applied to the original temple of Chersiphron; most probably it did not. The peristyle of the original temple was most probably approached by three steps in immediate proximity with the pillars, and consequently measuring 170 feet in extent. The 50-feet extension was probably due to Deinocrates, to whom we consequently owe the ornamental stylobate, which could not have existed in that of Chersiphron. It is, however, a curious illustration of how the design of the three temples was connected, that the foundation of the "universum templum" should only be an extension of the low podium of the first.

If the transverse dimension of 220 feet was found to apply only to the "universum templum," and to fit it so exactly, the longitudinal measurement of 425 feet ought to be applicable in the same manner and with the same exactness to the other dimensions. On the assumption that there were 127 columns in the temple it does so with admirable precision: thus—

	Feet.	Inches.
19 epistylia on the flanks, at 17 feet $1\frac{1}{2}$ inches - -	325	4
4 epistylia at the angles, at 19 feet 4 inches - -	77	4
2 half diameter of angle pillars - - - -	8	8
11 steps in front, at 19 inches - - - - -	17	5
English feet - - -	428	9

which is, as nearly as may be, equal to 425 Greek feet. It does not appear that these dimensions admit of any alteration to any appreciable extent, if Mr. Wood's determination of the length of the epistylia, which he seems to have ascertained with remarkable precision, is correct.

It is evident, as already mentioned, from its situation, there was no temple in the ancient world which could with more propriety be treated as possessing a back as distinguished from its front. In the rear, a range of columns similarly spaced with those on the flanks—as at Didyme and Athens—was all that was required, or indeed could be introduced, with architectural propriety. Originally, however, the posticum appears to have been approached by a flight of steps, similar to those of the pronaos, but when it was determined, from some cause or other, to obliterate these externally, by the introduction of the third range, a difference was introduced between the front and rear, which is not usual in Greek temples.

To those who are familiar only with the regular form of peristylar temple raised on an equal stylobate of three steps all round, it may appear anomalous that there should be a *perron* extending 17 feet in front of the pronaos, and that the basement is cut off steep at the posticum. But to those who are intimate with the principles of design that characterized the temples of the East such an arrangement must appear most appropriate and probable. In all the temples we know of in Assyria and Babylonia, the slope of the front is very gradual and adorned with flights of stairs. In the rear it is steeper and unapproachable. The temples at Borsippa and Mugheyr * are so constructed, and nothing would be more in accordance with eastern taste, than that such a feature should be introduced into this temple. The only thing that seems to militate against the idea that this feature was borrowed from the East is that it was not found—was not indeed possible—in the original temple, and was only introduced in that which was erected, and was altered, by the architect of Alexander the Great. As it happens, however, that architect was employed by him to design the city of Alexandria.† From his patron's long residence in Babylon, he must also have been familiar with the temples there, and was consequently most likely to have introduced this eastern feature into Ephesus. So far is its existence from being an objection, it is one of the many proofs of the correctness of the proposed restoration that it should have assimilated a local feature, not found in the other temples of the Greeks.

It must also be remembered that this is the only important temple we know of in the ancient world that was raised on a stylobate, 10 feet in height, and its podium consequently

* *History of Architecture*, vol. I, p. 152, woodcuts 46 to 49.

† Strabo, lib. XIV. p. 641.

required a different treatment from any other. That it was raised on a pyramid of plain steps as Mr. Wood represents it, appears to me, architecturally impossible. There may originally have been a flight of steps similar to that in front leading to the posticum, but their obliteration by the third range of columns must have appeared to those familiar with this oriental feature a great improvement in the appearance of the temple.

Assuming this to be so, we are now in a position to explain the one remaining puzzle, connected with the peristyle of this temple. There is a passage in Strabo in which it is said "Chersiphron originally built it, but afterwards another enlarged it."* This has generally been considered as a mistake or mistaken insertion, for how, it has been asked, when a classical temple is once finished, can it be enlarged? The obvious answer is, only by adding another range of columns at either end. In most temples this of course would be inadmissible, but not in all, and certainly not in this instance. It seems almost certain that, as originally planned by Chersiphron, the temple was dipteral, both in the flanks and in the rear, like the temples of Jupiter Olympius at Athens, and that at Didyme, erected by Païonius. That this was so in this case, is proved almost beyond question by Mr. Wood's discovery of about 6 feet of the first step of the original temple, exactly where we would expect to find it, 8 feet in front of the "universum templum," which at this end continued to be bounded by the second row of columns till the third range was added [Illustn. lxii. fig. 167]. As this was erected over the stairs that led to the opisthodomus, at this end, practically on them, it was not necessary or expedient to remove this mass of masonry, and if the temple had not now been so utterly ruined, the wonder is, that no more of this buried foundation has been found. But it is satisfactory to have found so much, as without it the mode in which the addition was effected might still have remained a mystery.

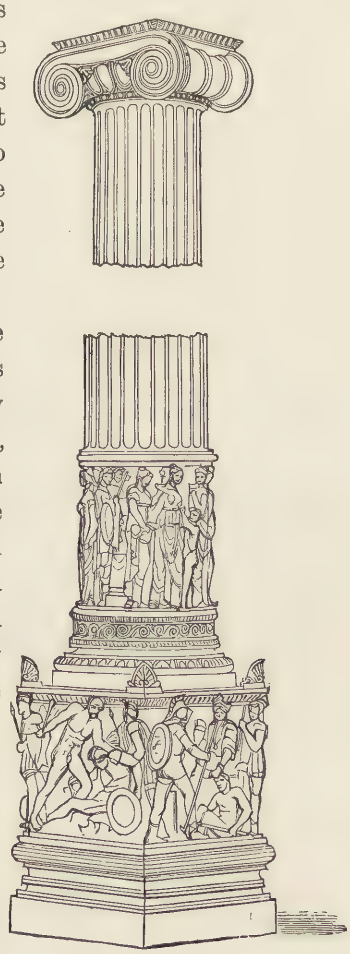
It is perhaps in vain now to speculate on the causes that may have led the Ephesians to introduce so unusual a feature as a triple row of columns in the posticum of their temple; but it may be suggested, that as they were in the habit of boasting that their temple was the largest and finest in the world, they felt hurt that, while the temple of Jupiter Olympius at Athens had 120 columns, and the neighbouring one at Didyme had the same number, theirs had only 118! which, owing to the octastyle arrangement of the front, was all it had as originally designed. It may also have been that, as erected by Deinocrates, only the three central columns of the posticum were "cælatæ," and it was afterwards thought it would be a great improvement to add a row of nine more, so as to bring up the number in the posticum to twelve, more exactly to balance the twenty-four of the pronaos. There may, however, be many other causes that led to its adoption which we cannot now be expected to appreciate, but whatever they were, it seems certain that this third row was added after the original temple was complete, and formed a unique feature in the design.

In order to make up the required number we have only to add another range of eight columns to the pronaos, and there is nothing in Mr. Wood's discoveries which would interfere with such an arrangement, while it would add immensely to the dignity and architectural propriety of the plan. It would enable the architect also to introduce five ranges of columns in the pronaos, as Païonius afterwards did so successfully in the sister temple at Didyme, where it must have formed, as it certainly did here, the most dignified and appropriate feature

* Χερσιφρων ηρχιτεκτόνησεν εἶτ' ἄλλος ὀποίησεμείζω, lib. XIV., page 640.

of the whole design. Another range of columns in front seems also indispensable to carry-out fully what seems to have been the leading idea of the whole design, which was, that the temple should have a front towards the city which should surpass in magnificence the back resting on the hill.

One of the most brilliant of Mr. Wood's discoveries was that of several of the drums of the columnæ cælatæ, with thirty-six of which, according to Pliny, the temple was adorned. Hitherto there has been nothing to guide us in trying to ascertain how these were distributed, but, by adopting the 127-column scheme, their position seems hardly doubtful. To maintain that subordination between the back and front of the temple which pervaded the whole design, the number of those in the rear seems to have been half of those in the front, and there seems only one way in which the twelve at the back could be artistically arranged—nine being in the front row and three in the second. At the west end of the temple the arrangement seems equally inevitable. The two front rows must, it seems, have been so adorned, and the six in the centre of the pronaos, and the two in front of the antæ.* If this were so there is no part of the design in which the architect has shown more skill than the mode in which he has sought to give, and succeeded in giving, prominence and dignity to the principal entrance of the temple, and his disposition of the columns, enriched by sculpture in this manner, is one of the most pleasing parts of the whole design.



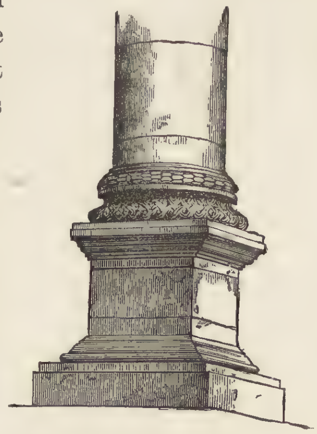
During the course of his excavations Mr. Wood found one sculptured drum, now in the British Museum, which was less in diameter than the other four which he found; they measured 6 feet ½ inch, this one only 5 feet 6½ inches (*Discoveries*, p. 266). From this he inferred—most probably correctly enough—that, allowing for the entasis of the column, it must have been placed nearly one third of the whole height of the column from its base. As it was found at the east end, he restored all the sculptured columns at that end, with three sculptured drums placed one over the other, an arrangement so thoroughly inartistic that I would have preferred to insert it alone, at the required height, like the rustication of the Italian Renaissance architects. As the temple was looked down upon from the hill behind it, at this end, and the disposition of the stairs was different, and it was essentially the back of the temple, there might have been some excuse for this treatment of the columnæ cælatæ. I believe, however, that a better solution of the difficulty will be found in assuming that the square blocks, which Mr. Wood

* In Illustn. lxii, fig. 167, the columnæ cælatæ, both circular and square, are distinguished by a dark line inside. The woodcut on this page is a proposed restoration of one of them.—J. F.

assumed to have been parts of the frieze of the temple, were really fragments of square pedestals on which some at least of the pillars were raised. If they were portions of the frieze, it is a most remarkable fact that he should have found and sent home the four angle-blocks of the temple, and not one stone of the intermediate parts, for all those in the British Museum are sculptured on the two contiguous faces. It is a still more curious coincidence that two of them still show the marks of a circular drum of the column having at one time been placed on them. Mr. Wood explains this by assuming that they belonged to one of the former temples, and were used in the last for a different purpose from that for which they were employed in the former one. It seems, however, almost impossible to understand what blocks in any previous temple should be so square, and solid enough to receive the marks of the frustum of a column on its summit, unless it had originally been intended as a pedestal for a pillar. There is, it must be confessed, some little difficulty in joining the pillars to the bases now found, and in the British Museum; some intermediate member seems to be wanting, but further study, when all the data are available, may supply this. In the meantime it is a trifling difficulty compared with those inherent in any other hypothesis that has yet been suggested.

If Mr. Wood would let us know where these fragments, which he supposes were portions of the frieze, were found, we should be in a better position to judge of the correctness of the adscription. So far as I can gather from his popular account, but it is difficult to be certain, for there is no index, they were found in positions that directly contradict his view, but as he has gone to Ephesus expressly to look for further portions of this frieze, he probably will, on his return, clear up this point.

Meanwhile, in so far as the evidence at present available goes, it seems sufficient to prove that a certain number of the columnæ cælatæ were raised on pedestals somewhat in the manner I have represented It was a very common mode of raising columns in the Roman times, as shown in the woodcut, and is so effective and artistic a mode of treating them, in certain positions, that it is most improbable that it was invented by them, but we cannot trace it back to the time of Alexander the Great, when the Ephesian temple was built. The question must therefore be discussed on its own merits; though if sculpture was carried-up higher on some than on others, it seems nearly certain that it was not by superimposing a number of drums on one another, but by some more artistic arrangement. The simple fact mentioned by Pliny that one was carved by Scopas is sufficient to indicate that it was not a mere circular base like those in the British Museum that he was employed upon. They are, from their form, incapable of real artistic treatment; a square base might be made worthy of his genius.



Base of Column at Kenawat.
(First Century A.D.)

If any of the pillars were more decorative than the others—it is easy to see which they were. The three central pillars in the second row of the posticum were probably so treated, and probably the three in front of them, six in all. In the pronaos, the ten that flanked the central avenue leading to the great door would almost certainly be so treated, and the two in front,

opposite the ends of the antæ, making twelve altogether, as shown on the plan [Illustn. lxii]. The example at Didyme might lead to the assumption that all the eight in front were so treated, making sixteen in front, which were raised on square bases; but till some further information is obtained, which is not likely now, this must be a matter of opinion only.

During his excavations, Mr. Wood ascertained with absolute certainty that the pillars of the peristyle of the third temple—that described by Pliny—were raised on a stylobate 9 feet 5½ inches above the level of the pavement of the courtyard. This was a unique feature not known to exist in any other Greek temple, but most important to enable anyone to understand the descriptions of the Ephesian temple that have come down to us. Although he did not in any place find one step resting on another, he was able to ascertain from the height of the first step, as well as other circumstances, that the risers were on an average 8 inches, and the treads 18 or 19 inches each. This involved an ascent of fourteen steps, and he so represented it in a pyramid of plain steps without any variation or ornament. So far from this being an ornamental feature, it would have gone far to destroy the effect of the temple by hiding the bases of the pillars from those in the courtyard, and otherwise destroying the connection of the peristyle with its base. But even if it certainly was not a plain pyramid of steps as Mr. Wood proposed, it is equally certain that it was not a plain solid podium which, even though ornamented with sculpture, would have been an architectural solecism that would have been intolerable. It evidently was a combination of both modes of treatment, and though there are no remains to enable us to determine its arrangement with certainty, there are indications that may enable us to ascertain its main features with very tolerable approximate certainty.

My own impression is that on the flanks the podium was divided into four solid blocks the end ones measuring about 60 feet each, the middle ones 80 feet; these were separated by three flights of steps, the central one of 60 feet, the two others of about 45 feet each, as shown on the plan [Illustn. lxii]. It would of course be mere pedantry to fix these proportions with anything like certainty. There are no data to enable us to do this, and it must consequently be left to the taste and judgment of the restorer to determine what he thinks best. In height there is fortunately the means to determine the proportions with certainty. There were altogether fourteen steps, with an average height of eight inches; three of these, as has been already explained, belonged to the original temple, and were extended in the third to a width of 425 feet in order to form a basement for the "universum templum." Beyond this, as we learn from Philo, "there was formed a basement of ten steps."* This is almost the only fact we get out of the fragment of this too rhetorical description, but as he certainly had seen the temple he was describing, there seems no reason to doubt the fact. The remaining step is indispensable to mark the front of the peristyle; usually there are three steps in Greek temples, but it seems quite impossible that the pillars should be placed on a flat platform without being bounded by at least one. The distance between this step, or the bases of the columns, and the top of the steps, Mr. Wood ascertained to be 15 feet 3 inches,† which is the exact measurement that results from the disposition of the steps shown in the section in the first woodcut herewith [page 159, *ante*].

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* De septem miraculis mundi.

† This dimension was furnished by Mr. Wood, as explained in a footnote, p. 88, of my previous Paper.—J. F.

In front the steps, I conceive, extended the whole width of the pronaos and of the inner alley of the peristyle; but even here I fancy it must have been expedient to divide them into three divisions by piers, so as to avoid monotony. In the rear, the arrangement was peculiar. When the arrangement was dipteral there, there seems to have existed a flight of steps extending, like those in the front, beyond the width of the cella. When the third row of columns was added, they were built on or over this *perron*, as evidenced by Mr. Wood's discovery of a fragment 6 feet in length of the original front step, but the steps were not removed, but allowed to remain, at all events between the pillars, in the position they originally occupied in Deinocrates's temple. Whether they were allowed to remain in the centre is not clear: I think not. All that was wanted here was access to the two doors, which almost certainly led to the opisthodomus and access to the peristyle. The four represented in the plan meet these requirements perfectly, and a solid centre would admit of sculptured adornment, without which this front would have been singularly deficient.

It does not seem to admit of any doubt—especially since the discovery of the sculptures of the Pergamos altar—that the faces of all these blocks were adorned by *bassi relievi* of the same character as those which adorned the columnæ cælatæ. The panels in which they would be placed work-out to exactly the same height (5 feet 6 inches), which is the height of the sculptures on the columnæ cælatæ, and that also of the frieze of the order, while the situation seems singularly well adapted to such a mode of adornment. Whether the figure sculpture was carried up the slope of the steps as at Pergamos is more doubtful: my impression is that it was not. In a monument which had only one flight of steps, and those leading to the platform of the altar which was the principal object of the whole arrangement, such an elaboration might be expedient. But where there were eighteen or twenty similar spaces, such treatment, which must always have been difficult, would be apt to become monotonous, and lead to *tours de force*, which would be by no means pleasant. It appears that a floral decoration would in such a situation have been much more pleasing, and might be varied in each position to any extent that might be thought desirable without any danger of monotony.

Two such groups as the Monte Cavallo horses would, architecturally, form fit adornments for the two pedestals that divide the principal stairs, though ritually they would hardly be appropriate to a temple of Diana, but it would in that age have been easy to design others as beautiful in effect and more appropriate to the situation. The four angles of the platform must also have required groups, consisting of several figures, probably combined, with candelabra or trophies of some sort. Besides these there are pedestals which would necessitate their being completed by at least sixty or seventy single statues, either in marble or bronze; and there must also have been altars and vases, and all the thousand-and-one objects of art with which the Greeks knew so well how to ornament their temples.

If any one can realize, in his mind's eye, the splendour of a temple of a pure Greek-Ionic order, adorned with 127 columns of white marble, 60 feet in height, and nearly one-third of which were sculptured to a considerable height above the bases, he will understand why the temple was so much admired by the ancients. If to this he will add that it was raised on a stylobate, on which were carved 700 feet of bas-reliefs, which was further adorned by at least six great groups of sculpture, and sixty or seventy statues either in marble or bronze, besides altars and minor objects innumerable, he will begin to appreciate the raptures into

which all fell, who in ancient times wrote about the temple of Diana at Ephesus. The Parthenon may have been more pure, but there was a glory about this temple, unsurpassed by that of any temple in ancient or modern times with which we are acquainted.

If the temple did not possess the 127 columns mentioned by Pliny, and its podium had not been ornamented by sculpture to at least the extent indicated above, none of these conditions would have been fulfilled, and this famous temple must be contented to rank only as the third or fourth in the ancient world.

I have very little to add to what I wrote in 1877 with regard to the disposition of the interior of the temple, and as little to alter in the arrangements then proposed, except of course in so far as the addition of twenty-seven columns to the peristyle necessitates a corresponding extension of the interior. One of the most satisfactory results of the extension is that it affords room for a cella 150 feet in length, which is what Mr. Wood discovered, though as there was not room for it in a temple of 100 columns, he found it necessary to shorten it by between 40 or 50 feet, to suit what he believed to be the available space. This increased extent makes it more imperative than it was before, that it should be lighted on both ends by a hypæthrum, as I proposed when I wrote my Paper in 1877. Since that time I have had occasion to go again over the subject carefully, while writing a description of the temple of Jupiter Olympius in my work on the Parthenon, and have seen no reason to alter the opinion I then expressed. I feel as strongly convinced as ever that the hypæthrum in great temples, as described by Vitruvius, was a large window occupying the whole width of the cella of the temples, and receiving its light from a court-yard 50 or 60 feet in width, which was "sub divo" and "sine tecto." Not only is there no mechanical difficulty in this, but it is, so far as I know, the most artistic mode of lighting a large hall that has yet been invented or used anywhere. Where two such hypæthra, as in this instance, are introduced, one at either end of the cella, it has been objected that a cross light would exist prejudicial to artistic effect. If the statue in the temple were a chryselephantine one, like that of Jupiter Olympius at Athens, this mode of introducing light might be objectionable. The image here, however, was a mere "simulacrum," not dependent for its effect on any mode of lighting. All that was required would be a hall with a sufficiency of light for it, and for all the images and pictures with which it was filled being sufficiently seen without any reference to the direction in which it was introduced. There were abundant means available by which any artistic defect of this sort, if it existed, could be easily remedied. Besides "velia" or blinds there was the "parapetasma," which we learn from Pausanias (Book v, chap. 12), rested on the floor of the temple, and on occasions when required was drawn up to the roof. Generally it is understood that these, which were curtains "of wool embroidered with all the lavish decorations of the Assyrians, "and dyed with the purple and other colours of the Phœnicians," were suspended in front of the statue of the god, to increase the effect by adding to the mystery with which it was regarded. To me it seems as likely that they were hung behind the image, to increase the effect by affording it a rich and appropriate background. Although I think this the more probable view of the case, it is a question that can hardly be profitably argued in this place, for we have so little experience to guide our judgment. The example that I know which most resembles the cella at Ephesus is the so-called Egyptian Hall at the Mansion House, but it is

only 69 feet wide instead of 70 feet, and 90 feet in length as compared with 150 feet. Even making every allowance for climate and other circumstances one window, even if somewhat larger than those found there, would not suffice. The two do not afford a cross light that is at all unpleasing, and any defect in this respect might easily be remedied if thought necessary by the means suggested.

This mode of introducing light necessitates the employment of a circular form of roof; in this instance certainly of wood, which might be made ornamental to any extent, and its effect was probably heightened by gilding, though hardly by colour. The cedar, of which according to Pliny * it was formed, would be more pleasing if left to its natural expression. The central avenue of the pronaos was certainly covered with a semicircular vault, either in wood or in stone. Its span, 23 feet in the clear, was too great for any horizontal treatment. If it was in wood, which it most probably was, the aisles or avenues next to the centre on either hand were also roofed with wood, but in this instance treated horizontally; and it is also probable that the lacunaria throughout the temple were also in wood; at least if this was not so, it is difficult to understand how such a temple could ever have been burnt. The testimony of Vitruvius may be taken as nearly conclusive on this subject,† even though, on the other hand, it is difficult to believe that so magnificent a temple should not have had marble lacunaria in the peristyles at least. The wide spacing of the columns in the pronaos renders it, however, almost certain that that part of the roof was in wood, and it therefore becomes probable that this mode of construction was carried throughout.

In the centre of this space of 150 feet Mr. Wood found the foundation of the altar,‡ about 20 feet square, which, as Strabo tells us, was "rich with the works of Praxiteles."|| There was of course nothing left to tell its form, and nothing but a drain to carry off the water used in cleansing it. It being placed exactly in the centre of the extended cella is of course another argument for the adoption of the enlarged form, but it also happens — and the coincidence can be hardly accidental—that it is exactly in the middle of the colonnade of 127 columns, equidistant from the outer ranges at the east and west ends.

There was nothing found to indicate where the statue of the goddess stood, it probably was 20 feet or 25 feet behind the altar, 100 feet from the western window. The gallery, which almost certainly extended across the temple, which we may assume was 20 feet in breadth and 40 feet in height, would with the balustrade in front of it be nearly sufficient protection from the effect of the cross light for artistic purposes. If instead of a balustrade 4 feet or 5 feet in height we substituted an opaque screen or painting 20 feet in height, this would do it effectually. Up to the capitals of the pillars in the upper side galleries, this should entirely exclude the light of the lower part of the east window from the eyes of a person standing on the floor of the temple opposite the statue, and would practically get rid of the cross light without materially interfering with the diffused light of this window for the purposes of illuminating the cella. It would also prevent those in the west gallery looking at the back of the statue (which would be undignified), and my impression is that this was the mode adopted.

When first it occurred to me that the temple must be extended from 100 columns to 127, I rejoiced that this enabled me to provide for an opisthodomus nearly in the proportion to the

* Lib. XVI. 40. † Vitruvius, lib. II. ch. 9. Ephesi in aede simulacrum etiam lucunaria ex ea (cedrus).
‡ *Discoveries*, p. 258. || Strabo, lib. XIV. p. 641.

cella, as that which had existed in the Parthenon at Athens. On reflection, however, it appeared that it was more important to provide for a second hypæthrum, and if that is conceded, the opisthodomus must be cut up as represented in the plan. Even then, however, there seems sufficient accommodation for all the purposes to which we know this class of apartment was applied. There is an entrance hall, 70 feet by 25 feet, in which offerings could be exhibited, which seems ample for the purpose, and 15 feet or 16 feet by 30 feet or 32 feet, is sufficient room for a staircase to lead to the upper galleries, which were an important feature in this temple. There were also two apartments in the pronaos which may have been used for the same purposes, and there are also the upper of the apartments in the opisthodomus. This, however, is a matter which everyone must decide for himself. There is nothing on the ground which gives the smallest indication of how these parts were arranged, and there is nothing in any writing of any ancient author that would guide us in settling the point. My own impression is entirely in favour of the two hypæthra, both for internal convenience and external effect in so long a temple, but if others do not feel this, I have nothing to urge in contradiction to their views. The lower part of the hypæthrum I presume was roofed over and lighted by a dwarf clerestory on its roof, like that I have proposed for the temple of Jupiter Olympius* at Athens, and drained into the angles either through pipes placed there or by open spouts. The quantity of rain that fell on these is so small that it could be easily managed, as practically their area was a courtyard that was quite separate from any part of the temple itself. If it is thought more consistent with ancient practice that this should drain into an impluvium in the centre, that is easily managed; but it appears to me a singularly undignified mode of arranging a central point in so magnificent a temple.

I have now run through all the points that occur to me as bearing on the disposition of this temple. In doing so, I have adopted all Mr. Wood's discoveries without disputing or omitting a single one: all I have done has been to supplement them from the descriptions by Pliny and others who knew the temple when it was standing in all its glory, while he only found fragments of it in the last state of ruin and decay. It ought to be a source of infinite gratification to learn that every discovery he made bears out and confirms, when properly interpreted, every word the ancient authors have written with regard to it, for hitherto, looking only at the results obtained by the spade and neglecting those due to the pen, the riddle has been insoluble. By combining both methods of research they have been easily reconciled, and have yielded an answer which enables the temple of Diana at Ephesus again to take rank as the greatest and richest of the ancient world, and as such to be ranked as one of the seven wonders which were considered preëminent for greatness and beauty among the works executed by human hands.†

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* See *The Parthenon*, &c., page 17. Also the TRANSACTIONS, 1861-62, pp. 17-36.

† In my plan of the temple [Illustn. lxii, fig. 167] I have adopted the same mode of graduated shading as that used by Mr. Wood in his book. The parts which he actually found *in situ* are shaded black. The parts whose position he ascertained with certainty, though he did not actually find them, are represented with diagonal hatching. The parts which are conjectural in his plans, and in mine, are represented by hatching perpendicular to the outline.—J. F.

XIII. THE TEMPLE OF DIANA AT EPHESUS, WITH ESPECIAL REFERENCE TO MR WOOD'S DISCOVERIES. (lxii)

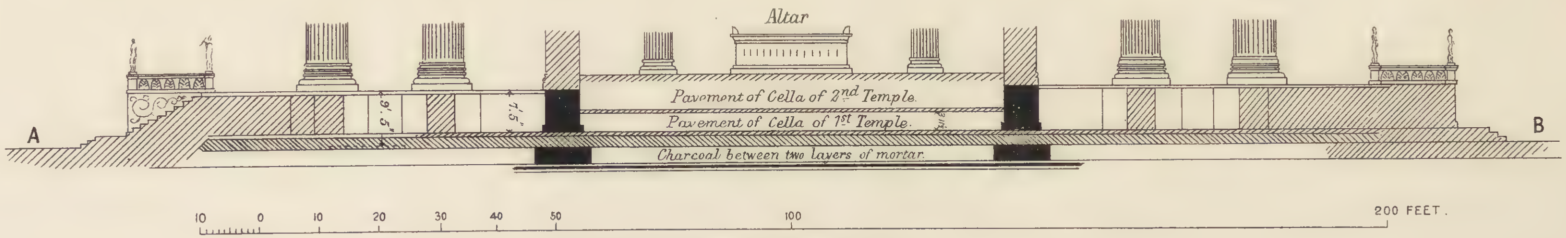


FIG. 168, Section through A.B.

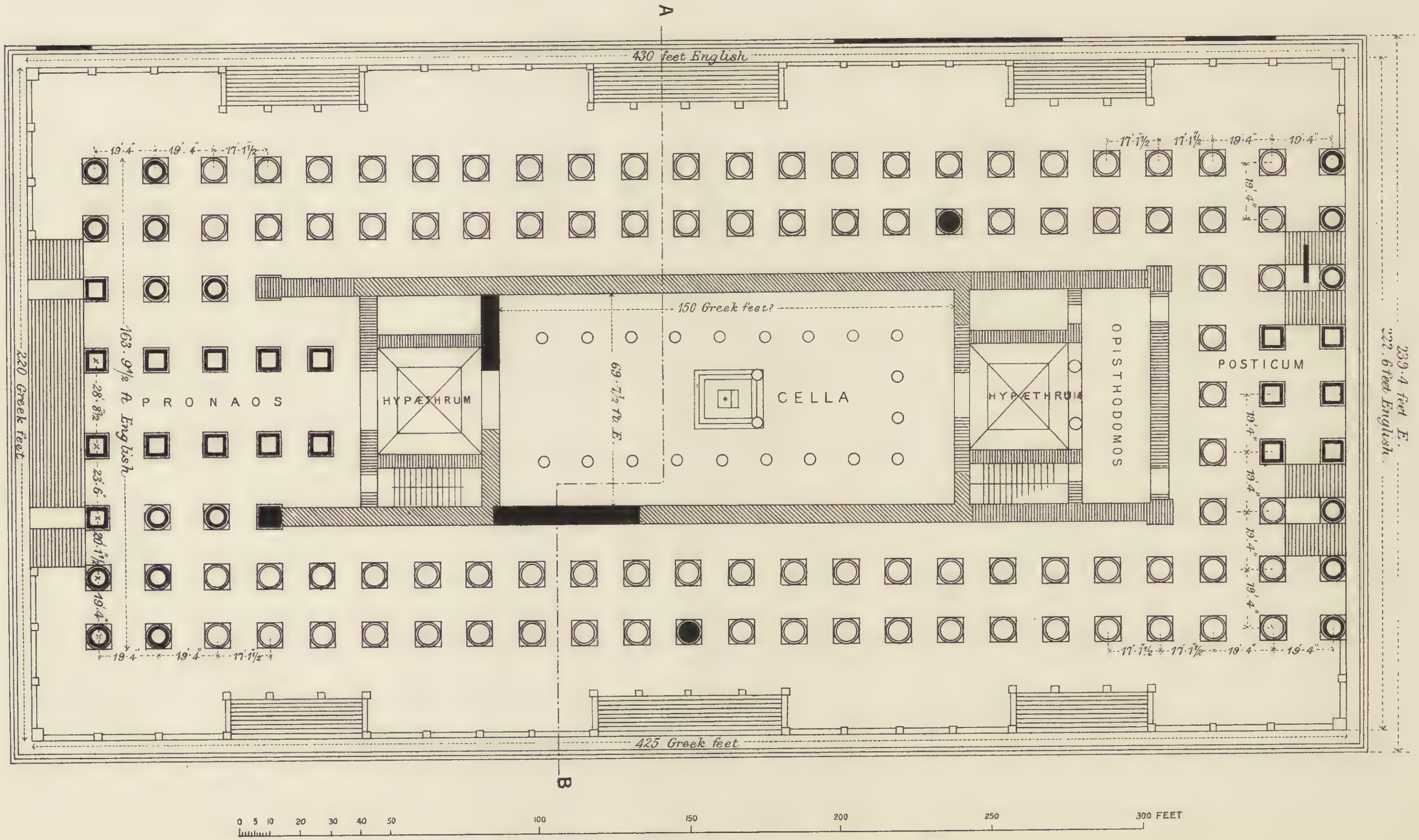


FIG. 167, PLAN OF THE TEMPLE AS RESTORED.

J Fergusson, Del.

C. F. Kell, Lith 8, Castle St. Holborn, London, E.C.

XIV. THE PUGIN TRAVELLING STUDENTSHIP: REPORT OF A TOUR IN CHESHIRE AND LANCASHIRE. By Francis Hooper, *Associate.*

[Addressed to the Council of the Royal Institute of British Architects, June 1883.]

Mr. President and Gentlemen,—

HAVING had the honour to be elected the Pugin Travelling Student for the year 1882, I chose with your approval Cheshire and Lancashire as the area of my tour, in order particularly to devote my attention to the domestic work with which those counties abound. But I there found so many fine examples of ecclesiastical architecture, that they engrossed a not inconsiderable portion of my allotted time.* Before, however, entering into details of the places I visited, I think it right to mention that much time was spent in obtaining access to the houses which I desired to study. Valuable as I found the general letter of introduction furnished to me by order of the Council, it was in many cases further necessary to obtain a personal introduction to the owners or occupiers of the houses which it was requisite for the purposes of this tour to invade; and I must express my obligations to several gentlemen who readily gave me assistance and the benefit

* Previous to commencing my tour in Cheshire I spent a day or two at Ludlow, in order to acquaint myself with such of the early features of English domestic architecture as are seen, for instance, in the ruins of Ludlow Castle, built in the twelfth century. This inquiry enabled me more readily to follow the general arrangements of the old halls of a later date in Cheshire and Lancashire.

Ludlow Castle, standing on the edge of a precipitous cliff, is protected on the flat side by a double bailey, in the outer one being the stables, &c., while in the inner one (protected by a dry moat) is the massive Norman keep or "donjon," a feature so prominent in buildings of this date. Opposite to the keep are the "state apartments," of a much later date, comprizing a spacious "great hall," kitchens, and withdrawing-rooms above; while in the centre of the inclosure is a circular Norman chapel, 27 feet 6 inches in diameter, said to have been built by Joce de Dinau in the time of Henry I, and on plan resembling that in the tower of the castle at Conway. An arcade runs round the lower portion of the interior, above which was inserted for the use of the family a timber gallery, approached doubtless from the private apartments by means of a bridge, but of which nothing now remains. The chancel no longer exists, but it probably extended almost up to the wall of the courtyard. Its width can be ascertained from the fragments on the east side of the chancel arch.

The parish church of St. Lawrence, of the fifteenth century, is cruciform in plan, with a lofty central tower rising above the crossing, the thrust on the nave and choir arches being met by a flying buttress over the aisles. The hexagonal porch on the south side of the nave is an unusual feature. The late perpendicular roof of the choir, enriched with carving and sculptured bosses, retains its colouring of green and red, relieved by bands of twisted black and white. The stall-work deserves particular attention; the carving and design of the stall-ends are very varied and good, the carving too beneath the "miserere" seats is remarkable.

Amongst the half-timber buildings in Ludlow, the Reader's house on the north side of the church, and the Feathers Inn, are the most interesting; the dining room of the latter, with its low plaster ceiling profusely decorated, the old fire-place and tête-à-tête bay-window on the first floor, are very quaint.

Passing on to Shrewsbury, the parish church of St. Mary is the principal object of interest. It is of very early foundation, and contains work of many periods. Time would be profitably spent in tracing some of the early alterations to the church, for instance, in the nave, where the Norman piers and arch-moulds have been replaced by early-English work, leaving the Norman rubble in the spandrils, and evidence of the position of the needling which was found requisite in making the alteration. Again, the original aisles being found too small were rebuilt much wider; the nave then being too dark, a clerestory was added at the end of the fifteenth century, and the present rich flat-pitched roof took the place of the high one.

This church is quite a museum of coloured glass (much of which is enamelled) collected from various parts of England and the Continent. The best windows are on the north side of the choir, while in the vestry there are some panels of Dutch work. Close to the church of St. Alkmunds is a group of curious old timber buildings called "Butcher Row."

Crossing the Severn by the English bridge the abbey buildings lie in front. On the left of the roadway is a very pretty little bit of timber framing, in a house bearing the date 1610.

Little remains of the abbey beyond the church, which being built of a soft red-stone has suffered much from the weather. The east end of the church has been completely destroyed, but the nave and west tower remain. The stone pulpit at the south side of the church, and standing by itself, marks the position of the ancient refectory.

At a short distance from the abbey is "Whitehall," a fine seventeenth-century house, approached through a picturesque gatehouse. In the grounds stands the pigeon-house of the neighbouring abbey, octagonal on plan and built of brick, some 22 feet in diameter. Under the eaves, which are about 20 feet from the ground, is a very effective cornice, formed by cusped brick arches about 16 inches wide, corbelled out from the wall which behind is stuccoed, so giving greater effect to the cusping. A very simple arrangement enables each of the thousand pigeon-holes to be readily examined from an upright ladder suspended on an arm from a central revolving post.

Whilst at Shrewsbury I visited Haughmond Abbey and Buildwas, in which are to be traced the early stages of the Norman transition, and I also visited Much Wenlock. The prior's house, two storeys in height, adjoins the chapter-house. Its continuous range of trefoil-headed windows, divided into bays by light buttresses, will delight even the most unromantic. The ruins of the church, chapter-house and cloisters are of much interest, belonging as they did to one of the most important of the Cluniac priories. The "Guildhall," built on posts over the cornmarket, contains a council-chamber of interest, on account of its oak panelling, its chimney-piece, and much of its furniture of the seventeenth century, which remain unaltered and un-restored.—F. H.

of their knowledge of the districts through which I travelled—especially to Mr. Henry Taylor, of Manchester, with whom I had the pleasure of visiting some of the old halls around Burnley and along the Ribble valley.

CHESHIRE.

The most interesting portion of this county lies between Nantwich and Stockport embracing the principal old Halls, which owing to the abundance of timber in the district were chiefly constructed of that material, as for example Moreton, Adlington, and Bramhall, in most of which will be found precautions for their defence in case of attack, as regards the choice of site, the disposition of the buildings, the water-supply, and in some cases, as at Moreton, secret means of escape when surrender became inevitable. In all houses of any importance a domestic chapel was reckoned indispensable by the household, and it will be noticed that the due orientation of this apartment governed the aspect of the main buildings. Again in every Hall erected, say prior to the middle of the 17th century, the "great hall" was one of the most important features, and on its embellishment funds were freely expended.

Combermere Abbey.—On first entering the county I visited Combermere Abbey, the seat of Lord Combermere, hoping to find something of interest as regards the arts of peace, but in this was disappointed, for the house has been almost entirely rebuilt, leaving but one small room of the old Abbey. The arts of war are, however, well represented in the entrance corridor and hall, which are lined with field guns, muskets, swords and pistols, trophies of engagements in which the late Field Marshal took a conspicuous part.

Nantwich.—The great attraction to the town is the parish church of SS. Mary and Nicolas, the beauty of its design being enhanced by the warm tone of the red sandstone of which it is built. The main portion of the present building is of the fourteenth century, but it occupies the site of an earlier church, of which there is evidence at the west end. Cruciform on plan a tower 34 feet square rises over the crossing, which immediately above the roof falls off to an octagon. The choir calls for special attention, on account of the beauty of its plan and richness of detail. It is divided into three bays, and lighted on each side by fine flowing traceried windows which on the outside are surmounted by ogee canopies, the finials of which stop under the corbel-table of the open battlemented parapet. The canopy to the east window is carried above the parapet, and is filled with open tracery, while inside it is flanked by two canopied niches for statuary. The roof is vaulted in stone, the buttresses outside finishing in lofty crocketed pinnacles. The arrangement of the choir stalls is worth notice, for instead of returning square against the screen in the ordinary way, they take an angle of 45° against the pier of the chancel arch, thus avoiding an awkward corner. Good detail will be found in the simple doorway on the north side, which leads to the vestry, and the stone pulpit standing against the north-east pier of the tower, as well as the sedilia of the choir and the oak altar-table, are worthy of remark.

Sandbach.—The church will be found of interest. The square tower carried on arches forms an open porch at the west end. Some of the tracery in the windows, though simple, is very good. The timber framed gables of the inn to the south-east of the church (once the residence of the Crewe family) are good examples of old work. To the north-west of the church stand two crosses, raised on pedestals of great antiquity.* On the sides of each cross are rude carvings representing incidents in the life of the Saviour.

Brereton.—A scattered village, in which the inn is the most prominent house. Brereton possesses a builder, who recently, by a most happy inspiration, divested this inn of sundry coats of plaster and whitewash, and thereby restored it to its pristine beauty. It is now one of the prettiest "black and white" inns in the neighbourhood. This praiseworthy individual, finding that the plastering was needed only because the original plaster had lost its key by the decay of the wattle-work, filled in between the timbers with half-brick nogging which, being plastered, now excludes the weather as it did of yore. The entrance to the inn is by a two-storey porch, such as is common in the district, having a cosy seat on each side of the doorway. A panel bears the letters W. B. M. (William and Mary Brereton), 1615.

With regard to the colouring of the timber and plaster buildings, black and white seems universal throughout Cheshire, the crudeness of the contrast being in my opinion most objectionable; at Speke, near Liverpool, the timbers are allowed to maintain their natural colour, while the plaster filling-in is finished in a rich cream colour, the whole harmonizing pleasantly with the surrounding foliage.

Congleton.—This is a picturesque little town. The "Swan and Lion" is a timber and plaster inn, with a two-storey porch, much as Brereton, but larger. There are several interesting scraps of old timber-work in the High Street.

* Much advantage may be derived from the perusal of a Paper on sculptured stone crosses entitled "the Churchyard Cross," by the Rev. E. L. Cutts, and published in the Transactions, 1866-67, pp. 121-130. It throws considerable light on the purpose of the isolated crosses so often met-with in this country and in Ireland.—F. H.

Moreton Hall.—Moreton Old Hall, about a mile from the Mow Cop Station, is surrounded on all sides by a moat, still averaging 25 feet in width, which can only be crossed by the stone bridge on the south side. As an example of half-timber work of different dates the hall is of great interest.

Crossing the bridge and passing through the carriage-porch one enters the quadrangle, which is inclosed by buildings entirely of half-timber, in front being the "great hall," with kitchen and offices. To the right are the domestic chapel and withdrawing-rooms, above which are the private apartments of the family, while behind are no doubt the rooms for guests, the top storey being appropriated as a ball-room, 10 feet wide by 70 feet long, with a range of mullioned windows on each side running the full length of the room. Similar apartments are found at Gawthorpe Hall, near Burnley, and Astley, near Chorley, Lancashire. In the front block is a secret room, entered only through a movable panel in the wainscoting of the room adjoining, and from which an underground passage could be reached through a hidden shaft by the side of the kitchen chimney.

The chief features of the building have been made familiar by innumerable views published from time to time, but none are so ample as the drawings of Mr. James Strong, which this year gained the silver medal of the Royal Institute of British Architects. Those drawings indicate, amongst other things, the open framing of the roofs, which have long been hidden by plaster ceilings. The roofs generally in this district are covered with stone, or more technically, grey slates, requiring on account of their weight great strength in the framing of the timbers.

Astbury.—Returning to Congleton it is as well to take the high road, and spend as long as possible at the church of Astbury, the finest village church in the county. It consists of nave and chancel, with north and south aisles, a west porch of equal height to the nave, in addition to north and south porches, while the square tower and belfry, surmounted by a stone spire, stands on the north side, almost detached from the church. It is the interior rather than the exterior which invites special attention. The church appears to have been constructed with a view to exhibit the work of the decorator to the greatest advantage. The roof is flatly pitched and well lighted, so that none of the carving is lost in gloom, as is sometimes the case. The clerestory windows are large, and when filled with coloured glass (as was evidently the intention of the architect) would still have afforded ample light to the nave, while between the sills of the windows and the crown of the nave arcade is a plain wall space some 5 feet high, inclosed at top and bottom by bold wall strings, divided only by the clustered shafts springing from the intersections of the label mouldings. This broad well-lighted wall-space was intended to be enriched by frescoes, as a small fragment on the north wall indicates—a mode of treatment recalling to my mind some of the mosaic decorations of the sixth century in the churches of Ravenna, North Italy, especially that of St. Apollinare Nuova.

For the purpose of giving the effect of greater length to the church the nave tapers eastwards, the piers being 30 feet 6 inches from centre to centre, while at the west-end they are no less than 34 feet 6 inches—a device open to criticism. The chancel is separated from the nave by a fine oak screen and rood-loft, in excellent preservation, the screens extending eastwards, and separating the chancel from the aisles; the choir stalls are also good. The roof of the south aisle will be found interesting, from the large number and the quaintness of the symbols of "the Passion," introduced into the carved corbels to the principals. In the churchyard are two canopied tombs, with recumbent effigies, quite unusual features.

Marton.—About four miles to the north of Congleton is the church of Marton, probably dating from the fourteenth century, constructed entirely of timber and plaster; it consists of nave and chancel, 14 feet 6 inches wide, with north and south aisles 9 feet 6 inches wide. At the west end is a timber-framed tower and belfry, surmounted by a low spire, around the base of the tower being a kind of narthex or ambulatory, somewhat similar to those at Navestock, in Essex, and Brooklands, Kent. The octagonal posts of the nave have solid moulded caps, and support an open framed roof, with curved braces; the nave and aisles being roofed together without a clerestory are lighted from three-light windows in the aisles, which originally had oak mullions with traceried heads, one of which only has survived restoration. The nave and aisle roofs are covered with grey slates, the tower and spire with shingles. The tower contains three bells, with inscriptions in good lettering: "Jesus bee our speed. 1616." "God save our Queen and realme. 1598." "1758" (date only).

Marton Hall is nearly opposite the church, a substantial half-timber building, now occupied as a farm-house. At a short distance is Siddington Church, like Marton constructed of timber, but not of equal interest.

Gawsworth.—About three miles westwards is the village of Gawsworth, a most naturally-favoured spot. In the midst of charming scenery is the church on rising ground, just above the lake, on the opposite side of which stands the rectory, a striking feature on account of its long "black and white" front.

The late-gothic church consists of nave and chancel of equal width, and without aisles, with a fine tower.

The nave roof is divided longitudinally by moulded beams, between which are curved ribs, inclosing concave plaster panels, and on these are traces of colour, while on the tie-beams are remains of figure-subjects. It is probable that originally the walls also were decorated.

The Rectory has a two-storey porch, by the door of which will be noticed some good ironwork; the "great hall" on the left of the entrance has an open timber roof.

In Gawsworth Hall is an octagonal bay-window, three storeys in height, said to be unique; but it seemed to me to be more curious than interesting.

Prestbury.—Some two miles to the north of Macclesfield is the quaint little village of Prestbury. The early-foliated caps on the south-side of the nave of the church should be noticed, also the rather unusual construction of the nave roof. There is something very taking in the simple two-light windows of the clerestory. The Sanctus bell-cot is an uncommon feature.

On the south-side of the church, and at some few yards distance, is a chapel of very rich Norman work, the west doorway of two orders being particularly rich in detail. Above is a band of enrichment in which sculptured figures are largely employed. The rest of the building is so embedded in ivy that it is most difficult to trace the design, but the disposition of windows can be traced from the inside, which is used as a choir vestry.

Adlington Hall.—This house was once entirely of timber. It has been largely rebuilt in brick and stone, but the north and eastern sides of the courtyard or quadrangle, inclosed by the house, remain almost untouched. The mediæval defences of this house are not evident at first glance, for on three sides the moat has been filled-in, and the stream which supplied it is now carried underground to the rear of the house, where it feeds a shallow lake, once part of the moat. Entering the spacious courtyard from the west-side, the "great hall," with its two-storey porch, is in front, the kitchen and offices being to the right. This kitchen block is two storeys in height, the upper one overhanging, and is remarkable for the massiveness of its timber framing. On the porch to the "great hall" is an inscription in spirited lettering, commencing as follows:—"Thomas Leyghe esquyer made this building in the yeare of o^r Lorde God 1581," &c. &c.

At Adlington, as in most other Halls, a passage runs through the building at the back of the "great hall," from which it is separated by screens, and across which the servants brought the viands from the adjacent kitchen. The length of this hall, exclusive of the passage, is 36 feet by 26 feet in width. The magnificent hammer-beam roof is divided into four bays. At the west-end above the dais and high table is a very bold canopy or cove, finished with a carved frieze, and divided by mouldings into numerous coffers, which are filled with emblazoned shields, displaying the arms of the owner and the alliances of his family. Beneath this canopy sat the squire, surrounded at the upper table by his family and guests, while his retainers occupied places according to their station at the trestle-tables ranged down the hall. Facing the high table, and over the passage above referred-to, is a gallery, occupied on special occasions maybe by a company of actors, making their "provincial tour," or by a wandering bard who in doggerel verse related the news of the last few weeks from the metropolis or the continent. In earlier times the "great hall" was also occupied as the sleeping apartment for the retainers who stretched themselves along the floor on shake-down beds. At Adlington this custom had been abandoned, the introduction of corridors having facilitated the provision of the more suitable sleeping accommodation which advancing civilization demanded. There is some good carving to the screens or "speares" of this hall, and the finely moulded timbers of the roof are remarkable. On the eastern side of the hall is a picturesque arrangement of roofs, and one or two lead rain-water heads are worth sketching. Between this hall and Rufford in Lancashire there is great resemblance both in construction and detail, though the latter is richer and more elaborate [Illustns. lxiii-lxvi.]

Bramhall.—This hall, now in the hands of a building society, is half-timbered throughout. Unlike the halls already seen this occupies a naturally strong position on rising ground. The present building forms but a portion of the original house, which was quadrangular, inclosing a courtyard as at Adlington. The house stands square with the compass, the domestic chapel, in which service is still performed, occupying the south-east angle. This chapel has a flat ceiling, with heavily-moulded beams. The east window contains some good heraldic glass, and also some figure-subjects.

To the north of the chapel is the "great hall" also with a flat ceiling, the fine withdrawing-room being above it. It is lighted mainly from the courtyard, on which side is the ladies' bay-window, thus the charming view over the valley of the Bollin is sacrificed for the greater protection from intruders.

The many and varied patterns of lead glazing here, as at Moreton, deserve attention, and amongst the furniture that remains of the once fine collection will be found some good 17th-century oak cabinets.

I took particular note of the timber framing in the east front both from a constructive and an artistic point

of view. The timber-work is raised from the ground on a stone plinth, and framed to carry the joists of the floor above, the ends of which, by overhanging the lower storey, not only admit of the construction of a larger room, but also form a protection from the weather to the timbering below; in the same way the filling-in to the gable of the roof overhangs, and the purlins project to keep the bargeboard well in front of the gable which it thus shelters. The upper portions of the vertical and horizontal framing are secured by angle-braces, which in themselves are made decorative. The bargeboard is enriched by a flowing tracery pattern, and the prominent horizontal timbers are treated similarly, not deeply cut, and so weakening them, but merely relieving the surface. The projecting ends of the joists are utilized for framing the ribs of a plaster cove, which gives a play of soft light and shade on the framing beneath. The mouldings of the mullions, transoms, sills and weatherings along this front, and of the bay windows in the courtyard, are well worth sketching, nor ought a curious little oriel on the south side of the courtyard to be overlooked.

Marple Hall.—Lying midway between Stockport and Disley this hall is said to contain a good collection of tapestry and armour. The façade is Elizabethan; at the side are some curious rain-water heads much resembling those at Lyme Hall, and lead guttering. The stables bearing the date 1669 are well known.

Baguley.—Lying to the left of the high road, about two miles beyond Cheadle, is a farm-house in which is incorporated all that remains of the once extensive mansion of Baguley. The "great hall" is almost perfect, though built in the fourteenth century entirely of timber and plaster. It is chiefly remarkable for the massiveness of its timbers, and the roof framed with carved cross-braces to each rafter. The hall is 28 feet by 34 feet 6 inches, but this length may have been greater before the fire, which destroyed some portions of the building, the end wall being now of brick. The usual features of the "great hall" recur here, viz. the passage at the kitchen end, the speares between which stood the movable screen and the separate entrances to the kitchen corridor, butlery and pantry. This corridor is vaulted in stone, and should be noticed.

Holford Hall.—Standing close to the Plumbley station, this hall, now occupied as a farm-house, is approached by a stone bridge of two arches over the moat. The parapet of this bridge taking the line of the projecting pier in the centre, forms a semicircular recess or refuge on each side, and gives a pleasing variety to the plan. The "black and white" front of the hall facing the bridge is elaborate, but the beauty of pure English work is wanting. The overhanging storey of the block to the right is carried on square oak posts, forming an open colonnade at the ground level, an arrangement which in our climate darkens the rooms even in summer, and affords but little shelter during rough weather.

Nether Peover Church.—This building, about a mile and a half to the east of Holford, is of special interest, being entirely constructed of timber and plaster, with the exception of the tower which is stone. The nave and chancel are 20 feet in width, and together consist of six bays with corresponding north and south aisles and a south porch. The octagonal oak posts of the nave arcade are 15 inches in diameter, and have moulded caps about 8 feet from the ground, the posts standing on stone bases. These posts, carried-up square above the caps, support the massive tie-beams of the roof-principals, the lines of the curved braces being continued to intersect under the tie. The tie-beams of the aisle roofs are decorated with sunk tracery patterns, which have a good effect. The nave is lighted, as at Marton, only from the aisle windows. The chancel screens and Jacobean pulpit are of some interest.

Chester.*—The most striking features for which the city is well known are the "rows." The upper storeys in the main streets, being built over the footway and carried on timber or stone piers, form a covered colonnade, the height above the roadway varying in a somewhat capricious manner, and approached by steps at varying intervals. Below the footways vaults exist, in many of which are traces of Norman and probably also of Roman work. The number of timber buildings within the city walls is still large, their high pitched roofs and overhanging eaves giving a most picturesque appearance to the narrow streets, but speaking generally the timber and plaster fronts are less interesting than might be expected, reminding one more of cabinet work than solid constructive carpentry. Amongst the houses I specially noted are Bp. Lloyd's and the Stanley House in Watergate Street, the "Bear and Billet" and the "Falcon" in Bridge Street.

The plan of the cathedral is somewhat unusual on account of the great length of the south transept, and the position of the cloisters on the north side of the nave. The early-decorated work of the choir deserves particular study. The south aisle contains two wall-tombs, which should be noticed, also the remains of the shrine of St. Werburgh. A press standing in a small chamber entered from the north aisle has some remarkably good thirteenth-century ironwork, very similar in character to that so well known in the cope-chests at York. The beauty of the choir stall-work cannot be overrated; the canopies for elegance and lightness are unsurpassed,

* Mr. Hooper's notes upon Chester and Manchester were much fuller than they are printed here, and were curtailed partly from want of space and partly from the fact of the two well-known cities having been so often described.

the details being most varied, yet completely in harmony. In conclusion, I desire to acknowledge my appreciation of the value of a learned Paper on this cathedral by the late Sir Gilbert Scott, read to the Chester Archæological Society in 1870, and published in the Society's Journal.

LANCASHIRE.

A tour in the south-east portion of this county will best be commenced from Manchester, which contains much of interest but chiefly the cathedral, Chetham's College, and Ordsall Hall. At a short distance is Middleton Church, also Agecroft Hall and Kersel Cell, Wardley Hall and the Old Peel Hall. In the neighbourhood of Bolton are Darcy Lever Hall, Smithills and Hall-i-th'-Wood. Near Burnley are Gawthorpe, Barcroft, Towneley and Worsthorn. Hoghton Towers, Rufford and Samlesbury are within easy reach of Preston, and Speke Hall, one of the most important old timber buildings in the county is near Liverpool.

Manchester*.—The cathedral is chiefly of the fifteenth century, and though suffering sadly from illusage still retains much of interest. The broad aisles and side chapels of the nave give remarkable spaciousness to that part of the church. The screen-work of the choir and lady-chapel deserve special notice, as also the choir-stalls.

Chetham's college, close to the cathedral to which it formerly belonged, is of great interest, and from the nature of its use as a school but few alterations have been made in the various apartments. The "great hall" is perhaps of chief importance, the arrangement being of the usual type of the fifteenth century. The roof is waggon-headed. A simple oak screen stands at the kitchen end, and above the dais is a bold oak canopy. At the end of the "high table" and opening on to the courtyard is the old "dole-window," whilst at the other end is a square recess with benches and table, probably called the "student's bay;" the ingle-nook, of unusual size, adjoins it, the windows of each overlooking the cloisters. The feoffee's room, a good oak-panelled apartment, is to the south of the hall. The loop-holes in the wall over the student's bay enabled the ladies in former times to watch, from an upper room, the festivities in the hall below, without themselves being visible. The cloisters are two storeys in height, continued round three sides of the courtyard, a most picturesque feature. The ancient kitchen too is a fine apartment, and the reading room of the Chetham library on the upper floor must not be overlooked.

Ordsall Hall, in Salford, is a fine timber building, once of great importance but now occupied as a working men's club. It contains a spacious "great hall," having a fine tie-beam roof unlike any yet noted, but is similar on plan to the ordinary type. The octagonal bay-window is a good feature, having a square apartment over, the angles of which over-hang. Adjoining the hall is the room termed the "solar," which has a most unusual bay-window, with semicircular projections at the sides, forming seats. The carved newels of the staircase are worth notice, as also the carving to the bracket under the small oriel window above the kitchen.

Agecroft Hall lies at a short distance to the north-west of Manchester, and is a fine half-timbered house in excellent preservation, standing on high ground by the river Irwell. The interior of the house having been altered to suit modern requirements, it is difficult to define the ancient apartments. One room, however, having an open timber roof, may be set down as the ancient "great hall," and the present dining-room was formerly the chapel. The eastern front contains several charming oriel windows on the upper floor, with richly-carved brackets. A small portion only of the open gallery round the courtyard now remains, the rest having been closed-in.

Peel Old Hall.—This, the ancient seat of the Kenyon family, has a fine half-timbered front. The "great hall," with flat ceiling, is in the centre of the building, having a square bay on the south side, opposite a large fireplace. The private apartments extend eastwards, some of them panelled in oak from floor to ceiling, the upper panels being decorated with incised work. In one is a richly-carved oak chimney-piece, filled with emblematical figures and family arms. The house is approached through a double courtyard. The gate-house, which is in the second of these, contains on the upper floor a large room, probably used in former times as the court-house, the lord of the manor sitting as magistrate.

The doorways in the east and west walls of the inner yard, above which the coping is stepped, pleasingly break the sky-line. The oak doors are uncommon; the three vertical panels finish with semicircular heads, with a carved rail at the springing-line. The lintel bears the date 1631.

Smithills.—This Hall retains much of interest, though the older portions are dismantled and allowed to fall into ruin. Three sides of the original quadrangle still exist, the central block being occupied by the "great hall" and butteries, of the fifteenth century. The former, the walls of which were of timber but are now rebuilt in stone, has a fine open timber roof, now almost hidden owing to the fact that a modern floor has been inserted

* See Note on the preceding page.

at the level of the wall-plates. The quatrefoil form taken by the wind-braces between the coupled principals is a frequent feature in roofs of this class, and looks particularly well in perspective. Traces exist showing the position of the ancient canopy over the dais, and also of the music gallery. The withdrawing-room, near the domestic chapel, is a fine apartment with flat ceiling and richly-moulded beams; it was formerly lined with rich linen-pattern oak panelling, now removed to a more modern part of the house. On the side of the quadrangle, opposite to the chapel (which has been rebuilt), are some interesting rooms with good furniture. The library has a curious Jacobean chimney-piece and heavily-carved doors.

Towneley Hall.—This hall, though much altered, still retains its ancient chapel and sacristy, of the fifteenth century, in perfect condition. The west end of the chapel has a low flat ceiling, with moulded beams, while the east end rises two storeys in height, the upper portion being richly decorated with traceried oak panelling. It may be presumed that the room over the west end once formed a part of the chapel, and was used by the family, who were thus separated from the household whilst attending the service.

Whalley.—Chiefly interesting on account of the ruins of the once-powerful Cistercian Abbey. There is some good work remaining in the cloisters, and also in the "hospitium," the only complete building, and now used as a barn, bearing evidence of the character of the work throughout, massive, dignified, and very bold in detail. The gatehouse also is preserved. The parish church contains much of interest. The tower at the west end is characteristic of those in the district, solid and square; the staircase projects boldly beyond the face of the wall, a source of strength instead of weakness, as is the case when concealed. The choir stalls and wood screen deserve notice, as also the bronze work on the south chancel door, which is apparently foreign.

Hoghton Tower.—This building, near Blackburn, is one of extreme interest, but until the last few years allowed to fall into decay. The present owner is now restoring it by degrees in a most admirable manner. The house erected towards the middle of the sixteenth century is entirely of stone, and standing on very high ground (on one side precipitous) commands a view of the whole surrounding district. The buildings are included in a double courtyard. A square tower rises over the gateway in the centre of the western side, having a low tower at each flank. The chief apartments surround the second and upper courtyard, and include the "great hall" on the north side, a spacious room with a flat ceiling, a music gallery at the west end, a large fireplace, and in the north and south sides semi-octagonal bays forming prominent features on the exterior. On the opposite side of the court is a set of rooms called King James's rooms, simply panelled. On the east side and extending beyond the general line of the building are the ruins of the domestic chapel, not square with the house, but turned to duly orientate.

Samlesbury.—This is a half-timber house, of the fifteenth century, probably quadrangular in former times. The "great hall" is of chief interest, having a massive open timber roof, and a ladies' bay. The beautiful oak screen, closely resembling that at Rufford, which once stood before the buttery doors, has within the last few years been mutilated, and introduced into the front of a sham music-gallery, erected at the dais end.

Rufford Old Hall.—This hall, situated near Ormskirk, retains but a very small portion of the ancient house, but this is of the greatest interest as it contains, without question, the finest "great hall" in the county. A plan and sections are given in Illustns. lxiii, lxiv, from which will be seen the great beauty of the construction, more especially of the roof, and the richness of the details. The roof is very similar to that of Adlington in Cheshire, but is in detail richer. Each of the sunk tracery panels of the braces below the hammer-beams are of different design, that next the "ladies' bay" bearing the sacred monogram I. H. S. in beautiful lettering, also emblems of "the Crucifixion."

In this hall there is no music gallery, as at Adlington, nor is the canopy over the dais so bold and lofty. Beneath the arch at the east end is a massive oak screen, richly carved and of early date; the heavy twisted finials seen in the sketch are late additions. The carving of the door heads, bosses and panels, deserves particular notice on account of its freedom and variety; the crest of the Stanley family (a vulture and child) is more than once introduced there, and again in the fragment of coloured glass in the bay-window. Views of the interior are given in Illustns. lxv, lxvi.

Speke Hall.—This building, situated near Liverpool, is perhaps the most complete and least altered half-timber house in the district. Built at the close of the sixteenth century, it was formerly surrounded by a moat, part only of which now remains, and is crossed on the east side by a stone bridge.

The arrangement of the house is that of a hollow square, a corridor running round the inside, interrupted only by the "great hall," a fine apartment, with flat ceiling and curious renaissance wainscoting, also two bay-windows, that on the garden side about 14 feet by 12 feet containing a fireplace. At the end of the hall is the ingle-nook, 14 feet wide and 5 feet deep, with seats on either side; the filling-in above the

battlemented chimney-piece being of brick, laid herring-bone fashion. At the side of the ingle-nook is the entrance from the kitchens, over which was the music-gallery, now blocked-up. The withdrawing-room, which adjoins the hall on the south side, is a fine wainscoted room, with a good raised-plaster ceiling, an elaborate fireplace, and a bay-window.*

* Many other places were visited and described by the student during his tour, and though some of these afforded opportunities for the pencil and the brush, they either did not suggest special comments, or the remarks made upon them have for various reasons been eliminated from this Report. The MS. Notes are, however, preserved in the Library of the Institute, though the measured drawings which accompanied them, according to the conditions of the studentship, were returned to the student after having been deposited for six months in the Library. The sections and interior views of Rufford Hall [Illustns. lxiii-lxvi] are reductions by photo-lithography of Mr. Hooper's measured drawings, which were chosen from among a large number of similar drawings and sketches as best fitted to illustrate the character of his work.

FINIS.

XIV. THE PUGIN TRAVELLING STUDENTSHIP. TOUR IN CHESHIRE AND LANCASHIRE (lxiii)

RUFFORD : OLD : HALL
NEAR : ORMSKIRK : LANCASHIRE :

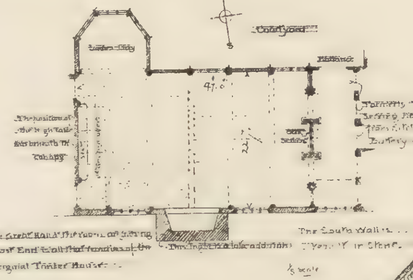


FIG 169. PLAN OF THE HALL.

All the Timber is Oak. The joints of the framing being invariably mortised. The heads of the oak pegs have not been cut off but project from 1" to 1½" from the face of the Work.
The Roof is covered with "Grey" or Stone Slates on wide oak boarding.

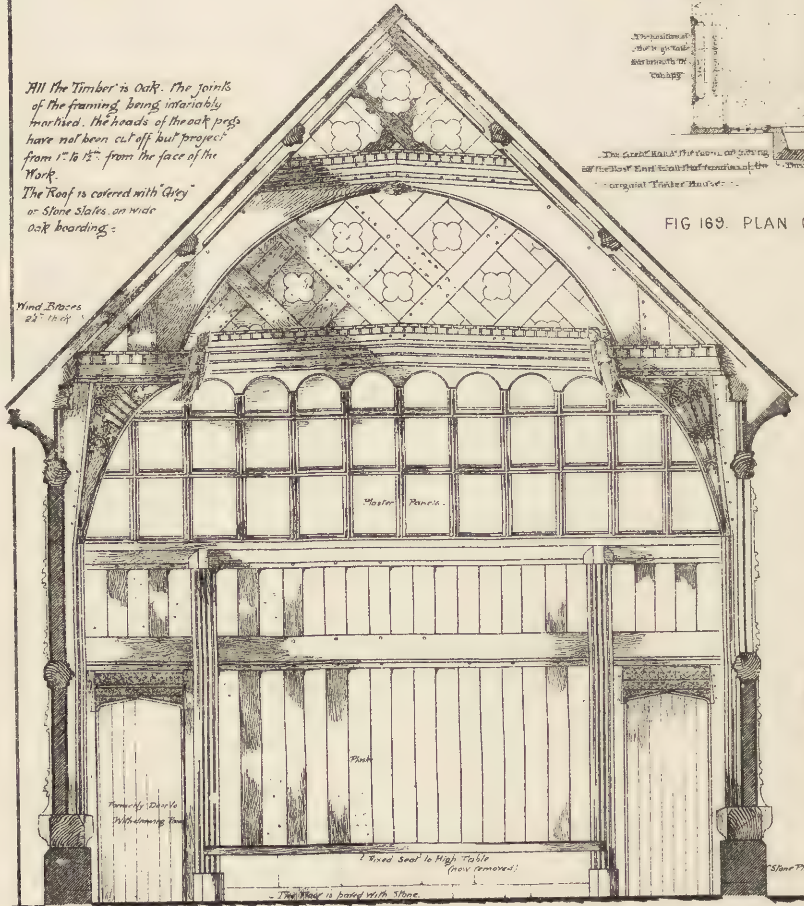


FIG. 170 CROSS : SECTION : LOOKING : WEST

A considerable part of the South side has been rebuilt in stone and a fire-place added.

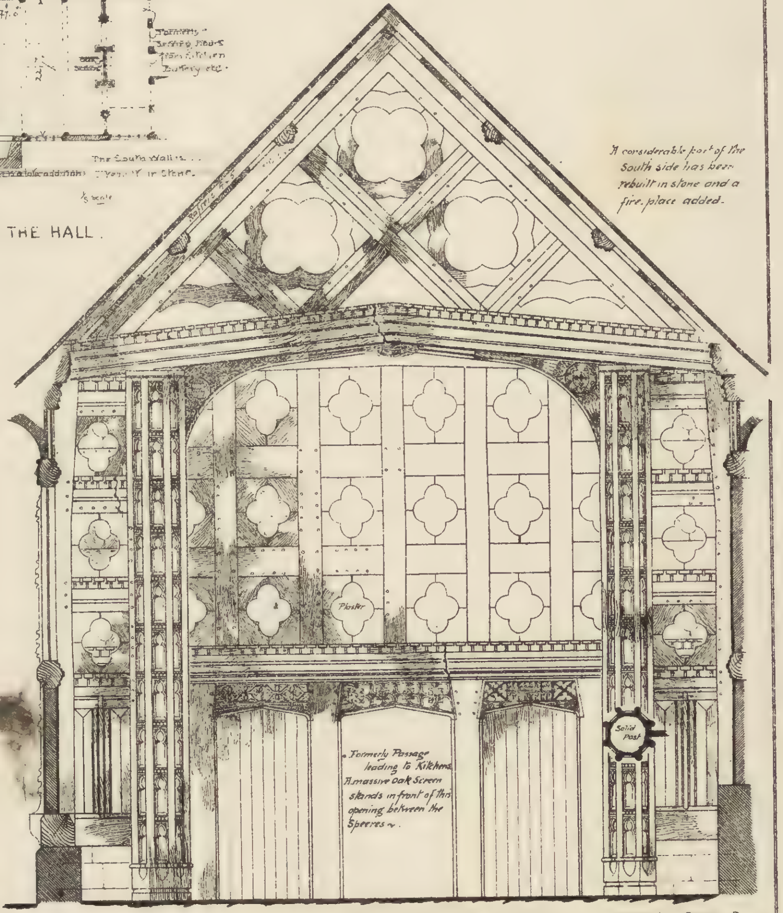


FIG. 171. CROSS : SECTION : LOOKING : EAST

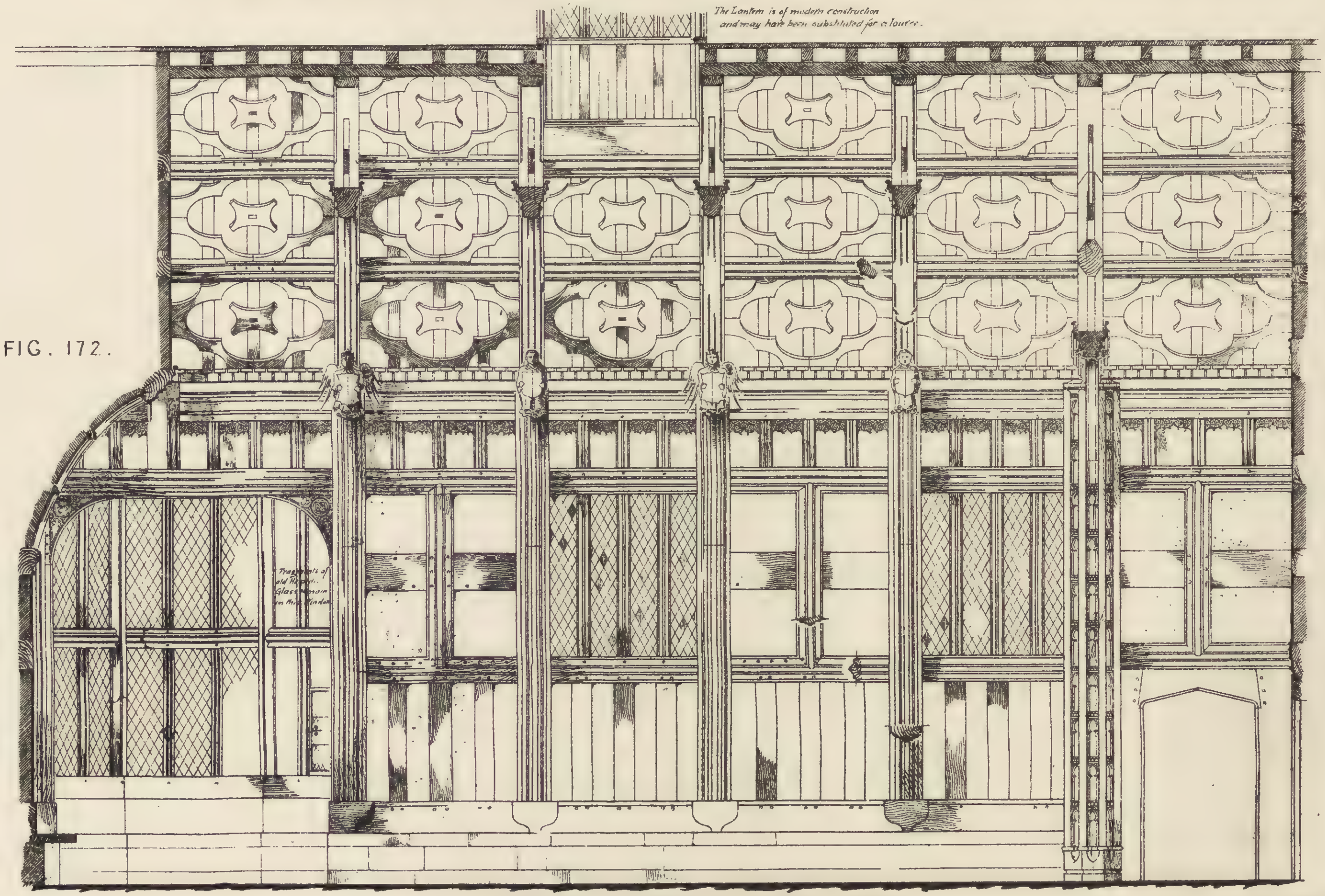
Scale of Feet.

measured August
drawn December } 1882
Francis Hooper

XIV. THE PUGIN TRAVELLING STUDENTSHIP: TOUR IN CHESHIRE AND LANCASHIRE (lxiv.)

RUFFORD : OLD : HALL
NEAR : ORMSKIRK : LANCASHIRE :

FIG. 172.



LONGITUDINAL : SECTION : LOOKING : NORTH

Scale of Feet

measured August } 1882
drawn December }
Francis Hooper.

C F Kell Photo-Litho. London E C

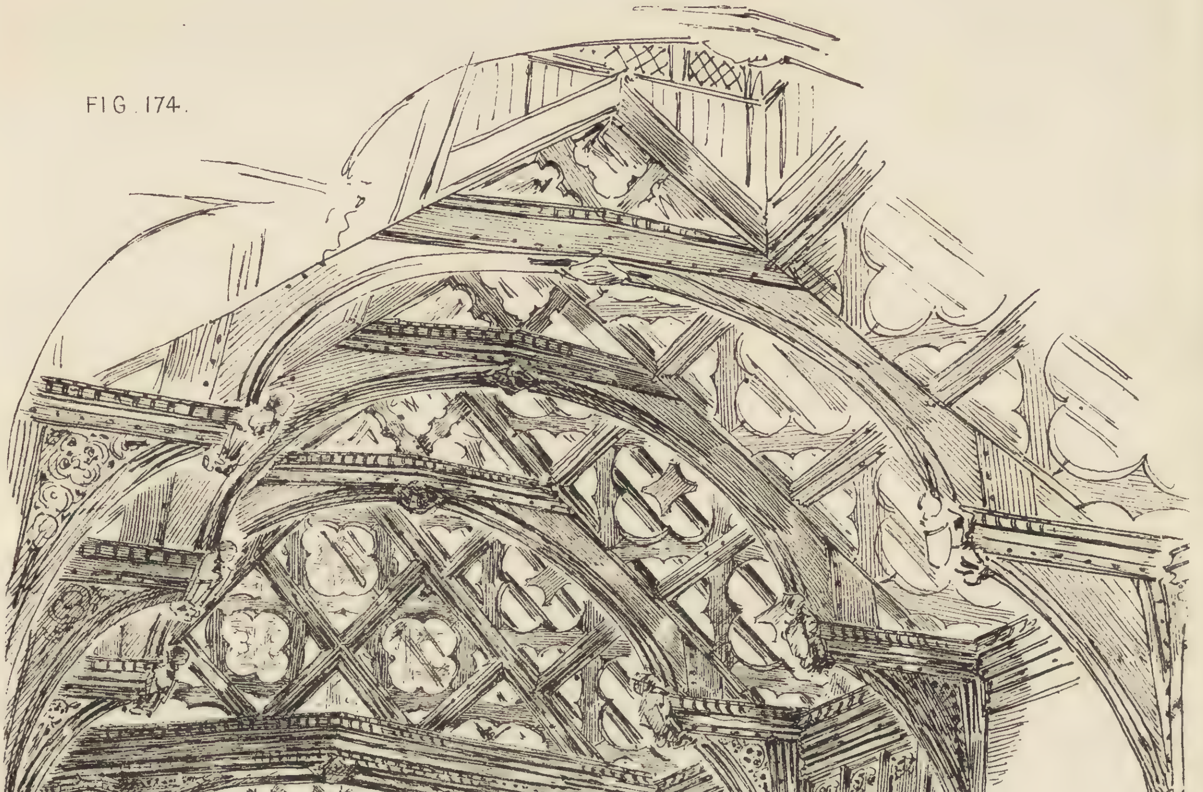
FIG. 173.

Interior of Rufford Hall looking towards The high Table.

Francis Hooper. Aug. 1882.

C. F. Kell, Photo-litho London E. C.

FIG. 174.



~ Interior of Rufford Hall ~
looking towards
the Screens.

Francis Hooper.
Aug. 82.

C.F. Kell, Photo-Litho. Castle St Holborn, London, E.C.